

2016

California Electric Reliability Investor-Owned Utilities Performance Review 2006-2015

This report reviews the reliability metrics data for California's three large investor-owned electric utilities over the ten year period, 2006-2015. Using the four annual reliability metrics adopted by the California Public Utilities Commission to measure system performance on a local and state-wide basis, this review presents a detailed summary of reliability performance for ten years by utility and region. The reliability metrics make evident that California's electric system has had a high level of reliable service overall and reliability performance has improved over the past ten years. The metrics are also useful in identifying areas of the State that saw significant improvement in reliability performance and areas where improved performance has been formidable.

Martin Kurtovich, Principal Author
Policy and Planning Division

Marzia Zafar, Director
Policy and Planning Division





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California Electric Reliability

Investor-Owned Utilities

Performance Review

2006-2015

May 9, 2016



Executive Summary

Reliable electric service with a minimal of outages and rapid restoration time is essential. California's three large investor-owned electric utilities (IOUs) in California, Pacific Gas & Electric Company (PG&E), Southern California Edison Company (SCE), and San Diego Gas & Electric Company (SDG&E) are responsible for providing a high level of reliability performance on their electric systems and tracking and reporting this performance to the California Public Utilities Commission (CPUC). Recent state legislation and CPUC rulemaking has updated the reliability reporting program to enable more transparency with more detailed reporting requirements on an annual basis.

This review examines 10 years of data for four reliability metrics recently adopted by the CPUC that measure reliability performance in terms of -

- 1) outage duration,
- 2) outage frequency,
- 3) average outage per customer and
- 4) number of momentary outages.

This report used data provided by the IOUs regarding all generation, transmission and distribution outages, excluding planned and California Independent System Operator (CAISO) outages. Each utility's system wide reliability metrics are compiled statewide to identify system performance over the past decade. Additionally, these metrics are broken down into 60 local jurisdictions as defined by the utilities for monitoring reliability. These utility districts or divisions are then grouped into 10 separate regions. By conducting a descriptive analytic review of these metrics, this report establishes a benchmark of California's reliability performance. In the future, such reviews will incorporate additional data provided from the IOUs through their annual report and online data on each utility's website.

Overall, California reliability has improved over the past decade. While reliability in the SDG&E service territory has maintained a consistently high level of reliability, both PG&E and SCE have improved and are approaching SDG&E in terms of level of reliable service. Particularly in PG&E service territory, marked improvement in reliability metrics are seen in the historic data, with particular improvement observed in the Central Valley and Bay Area.



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Acronyms and Abbreviations

Avg. SAIDI_{Years 1-5} – Average annual SAIDI for years 2006-2010

Avg. SAIDI_{Years 6-10} – Average annual SAIDI for years 2011-2015

CAIDI – Customer Average Interruption Duration Index

CAISO – California Independent System Operator

CPUC – California Public Utilities Commission

MAIFI – Momentary Average Interruption Frequency Index

IEEE – Institute of Electrical and Electronic Engineers, Inc.

IOU – Investor-Owned Utility

N_i – number of interrupted customers for each sustained interruption event during the reporting period

N_{mi} – Number of interrupted customers for each momentary interruption event during the reporting period

N_T – Total number of customers served for the area

PG&E – Pacific Gas and Electric Company

SAIDI – System Average Interruption Duration Index

SAIFI – System Average Interruption Frequency Index

SCE – Southern California Edison

SDG&E – San Diego Gas & Electric



Introduction

Section 364 of the Public Utilities Code ascribes the California Public Utilities Commission (CPUC) with the regulatory authority to ascertain and adopt reasonable standards and regulations for electric utilities performance as a means of ensuring high quality, safe, and reliable service. The CPUC implemented Section 364 over many years to provide the electric utilities with standards and guidance regarding what constitutes a reasonable level of reliable service, primarily through two General Orders (GOs) (GO 165 and 166) that specified reliability reporting for electric utilities.

In 2011, the CPUC ordered the investor-owned utilities (IOUs), including Pacific Gas and Electric Company (PG&E), Southern California Edison Company (SCE) and San Diego Gas and Electric Company (SDG&E) to report on reliability utilizing the Institute of Electrical and Electronics Engineers (IEEE) 1366 reliability metrics. In 2013 new legislation, Assembly Bill 66 (Muratsuchi), added Section 2774.1 to the Public Utilities Code which directed the CPUC to require an electrical corporation to report annually on frequency and duration of electrical service interruptions by local area, and included a requirement to rank areas by the most frequency and duration of outages. The legislation specifies that this information should be used to require cost-effective remediation of reliability deficiencies if repeated deficiencies in the same local area are identified. The intent is to provide Californians transparency regarding electric reliability, with readily accessible information that can be utilized for better public accountability, capital planning, and asset management.

Utility Reliability Data

The data used for this review was provided by the three utilities. The reliability data includes all outages with the exception of planned or California Independent System Operator (CAISO) outages. The data for 2015 may be viewed as tentative since the utilities have not filed formal reliability reports with vetted results. Final 2015 metric values will be published in July when the utilities release their annual reliability reports.

It should be noted that the method for calculating these metrics by the CPUC differs from the IOU methodology. In the CPUC methodology, local area metrics include all generation, transmission, and distribution outages, excluding planned and CAISO outages. For local areas, utilities omit generation and transmission outages. The CPUC methodology attempts to get an accurate measure of how outages impact ratepayers and so all outages are included.

Online utility reliability data is an important means for improving transparency and understanding of utility performance to utility customers. Currently each IOU has its own approach. The recent rulemaking included a requirement that all three utilities produce reliability web resources modeled after SCE's model. In the future, CPUC reliability reviews will incorporate these web resources to better provide access to information about annual reliability performance.



Utility Divisions and Districts

Reliability metrics are reported by each IOU on both a system wide (service territory) basis and starting in 2016 by division or district. Each IOU subdivides its service territory into sub regions, called divisions by PG&E and districts by SCE and SDG&E. PG&E has 16 within its service territory. SCE and SDG&E have 38 and 6 districts, respectively. For this review, the divisions or districts were grouped into 10 geographic regions and are listed in Table 1. In total there are 60 sub regions that are tracked using the four reliability metrics. Figure 7 shows the locations of these sub regions.

Figure 1





Table 1

List of California Investor-Owned Large Electric Utilities Districts or Divisions

Northern Region

- 1) PG&E *Humboldt*
- 2) PG&E *Sonoma*
- 3) PG&E *Sierra*

Bay Area Region

- 4) PG&E *North Bay*
- 5) PG&E *San Francisco*
- 6) PG&E *East Bay*
- 7) PG&E *Diablo*
- 8) PG&E *Mission*
- 9) PG&E *Peninsula*
- 10) PG&E *De Anza*
- 11) PG&E *San Jose*

Central Valley Region

- 12) PG&E *North Valley*
- 13) PG&E *Sacramento*
- 14) PG&E *Stockton*
- 15) PG&E *Yosemite*
- 16) PG&E *Fresno*
- 17) PG&E *Kern*
- 18) SCE *Kernville*
- 19) SCE *San Joaquin*
- 20) SCE *Tehachapi*

Coastal Region

- 21) PG&E *Central Coast*
- 22) PG&E *Los Padres*
- 23) SCE *Santa Barbara*
- 24) SCE *Thousand Oaks*
- 25) SCE *Ventura*

Los Angeles County (West) Region

- 26) SCE *Catalina*
- 27) SCE *Dominguez Hills*
- 28) SCE *Long Beach*
- 29) SCE *Santa Monica*
- 30) SCE *South Bay*

Los Angeles County (East) Region

- 31) SCE *Antelope Valley*
- 32) SCE *Covina*
- 33) SCE *Monrovia*
- 34) SCE *Montebello*
- 35) SCE *Valencia*
- 36) SC E *Whittier*

Orange County Region

- 37) SCE *Fullerton*
- 38) SCE *Huntington Beach*
- 39) SCE *Saddleback*
- 40) SCE *Santa Ana*
- 41) SDG&E *Orange County*

Inland Empire Region

- 42) SCE *Arrowhead*
- 43) SCE *Menifee*
- 44) SCE *Ontario*
- 45) SCE *Foothill*
- 46) SCE *Palm Springs*
- 47) SCE *Redlands*
- 48) SCE *Wildomar*

Desert Region

- 49) SCE *Barstow*
- 50) SCE *Bishop*
- 51) SCE *Blythe*
- 52) SCE *Ridgecrest*
- 53) SCE *Victorville*
- 54) SCE *Yucca Valley*
- 55) SCE *Shaver Lake/Big Creek*

San Diego Region

- 56) SDG&E *Eastern*
- 57) SDG&E *Northeast*
- 58) SDG&E *Beach Cities*
- 59) SDG&E *Construction Metro*
- 60) SDG&E *North Coast*



Electric Reliability Metrics

In 2016, the CPUC completed a new rulemaking (R.14-12-014), codified in Decision 16-01-008, that updated the annual electric reliability reporting requirements for California electric utilities. In recent years reliability reporting has improved with the development of national IEEE reliability metrics, first released in 2003. California's new reliability reporting requirements specify the use of the current standard, known as IEEE 1366-2012. The four specific reliability parameters that California IOUs are required to measure are

- 1) System Average Interruption Duration Index (SAIDI) as a gauge for outage duration
- 2) System Average Interruption Frequency Index (SAIFI) as a gauge for outage frequency
- 3) Customer Average Interruption Duration Index (CAIDI) as a gauge for average time to restore service, and
- 4) Momentary Average Interruption Frequency Index (MAIFI) which track the number of outages that last less than five minutes

Outage Duration

Outage duration is tracked through the System Average Interruption Duration Index (SAIDI) which indicates the total annual duration of outage interruptions per customer. It is measured in minutes.

System Average Interruption Duration Index (SAIDI) =

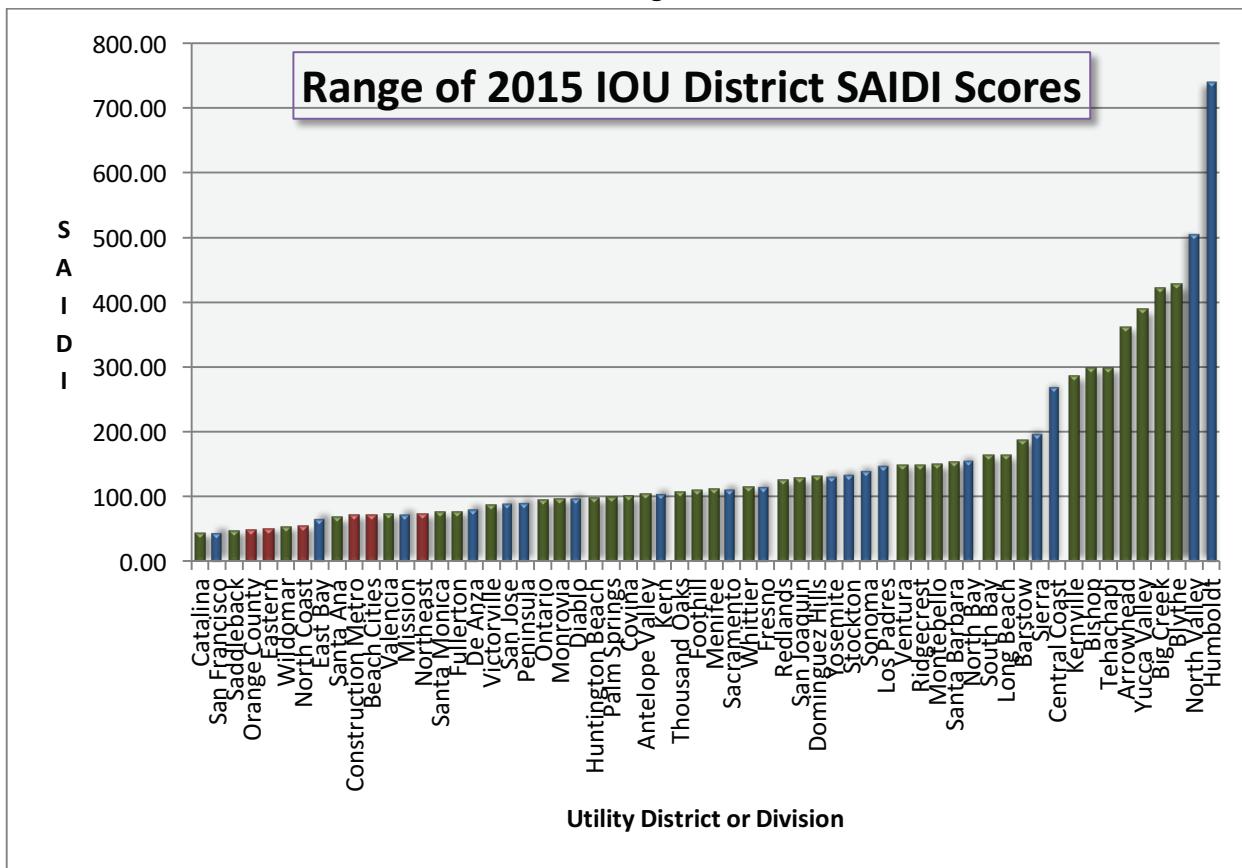
$$\frac{\text{Total minutes customers were without power due to sustained outages}}{\text{Total number of customers}}$$

It is calculated by multiplying the restoration time for each outage by the number of interrupted customers per outage, summing up the total for that year, and dividing by the total number of customers served.

$$\frac{\sum(\text{restoration time for each outage})(\text{Number of interrupted customers for each event})}{\text{Total Number of Customers Served}}$$



Figure 2



The 60 sub regions that the IOUs use to track the four indices, the above chart shows the range of values for the SAIDI metric for 2015, ranging from SCE's Catalina district having the least number of outage minutes in 2015 with a SAIDI of 43, to PG&E's Humboldt Division having the highest number of outage minutes with a SAIDI of 741. The above chart shows the 2015 SAIDI scores for all 60 districts or divisions, with PG&E divisions shown in blue, SCE districts in green and SDG&E districts in red. Note that 50 of the 60 sub-regions had scores below 200. Tables 2 lists the districts or divisions with the five highest SAIDI scores for 2015. Table 3 lists those with the five lowest SAIDI scores for last year.

Table 2
Five Highest 2015 SAIDI Scores

Utility District/Division	Utility	2015 SAIDI Score	10 Year Average SAIDI
Humboldt	PG&E	741	664
North Valley	PG&E	506	541
Blythe	SCE	427	477
Big Creek	SCE	423	1134
Yucca Valley	SCE	389	304



Table 3
Five Lowest 2015 SAIDI Scores

Utility District/Division	Utility	2015 SAIDI Score	10 Year Average SAIDI
Catalina	SCE	43	162
San Francisco	PG&E	45	89
Saddleback	SCE	46	100
Orange County	SDG&E	48	125
Eastern	SDG&E	50	141

Outage Frequency

Outage frequency is tracked by the System Average Interruption Frequency Index (SAIFI) which indicates how often a customer experiences a sustained interruption on an annual basis.

System Average Interruption Frequency Index (SAIFI) =

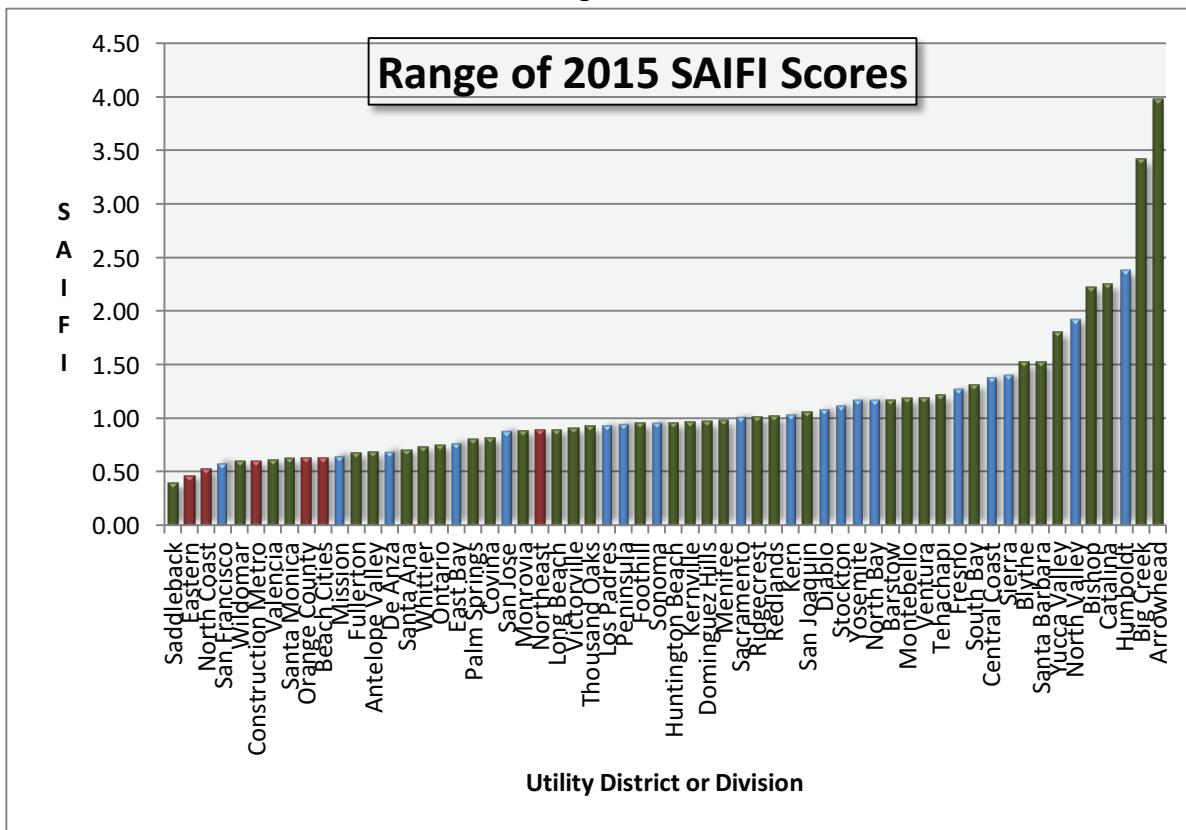
$$\frac{\text{Number of sustained customer outages experienced by customers}}{\text{Total number of customers}}$$

It is calculated by totaling the number of customers impacted per outage during the year, divided by the total number of customers served.

$$\frac{\sum (\text{Number of Customers Interrupted per outage event during year})}{\text{Total Number of Customers Served}}$$



Figure 3



As shown above in Figure 2, for 2015 the SAIFI metric on a local level ranged from less than 0.39 to 3.97. A total of 53 sub regions had scores were below 1.50.

Table 3
Five Highest 2015 SAIFI Scores

Utility District/Division	Utility	2015 SAIDI Score	10 Year Average SAIDI
Arrowhead	SCE	3.97	3.11
Big Creek	SCE	3.42	3.84
Humboldt	PG&E	2.38	2.29
Catalina	SCE	2.25	2.38
Bishop	SCE	2.22	1.28

Table 4
Five Lowest 2015 SAIFI Scores

Utility District/Division	Utility	2015 SAIDI Score	10 Year Average SAIDI
Saddleback	SCE	0.39	0.75
Eastern	SDG&E	0.46	0.72
North Coast	SDG&E	0.52	0.71
San Francisco	PG&E	0.58	0.797
Wildomar	SCE	0.60	0.88



Average Time to Restore Service

The average time to restore service is indicated by the Customer Average Interruption Duration Index (CAIDI) and represents the average time required to restore service to customers per sustained interruptions

Customer Average Interruption Duration Index (CAIDI) =

$$\frac{\text{Total minutes of outage duration}}{\text{Total number of customer interrupted}}$$

This metric is calculated by multiplying the restoration time for each outage by the number of interrupted customers for that outage, summing up the total for all outage events for the year and then dividing by the sum of all customers interrupted per outage event.

$$\frac{\sum(\text{restoration time of each outage})(\text{Number of interrupted customers for each outage})}{\sum(\text{Number of interrupted customers for each outage})}$$

And is equivalent to SAIDI divided by SAIFI or CAIDI = $\text{SAIDI} \div \text{SAIFI}$

In 2015, the CAIDI metric ranged from 19 at SCE's Catalina District to 311 at PG&E's Humboldt Division. For this report, the CAIDI for the local areas was calculated by the CPUC from the submitted data on SAIDI and SAIFI.

Average Frequency of Momentary Interruptions

A momentary interruption is a brief loss of power delivery to one or more customers. The average frequency of momentary interruptions that a customer experiences during a year is indicated by the Momentary Average Interruption Frequency Index (MAIFI).

Momentary Average Interruption Frequency Index (MAIFI) =

$$\frac{\text{Number of customers who experience momentary interruption}}{\text{Total number of customers}}$$

This metric is calculated by summing the total of the number of momentary interruptions during the year multiplied by the number of interrupted customers and dividing by the total number of customers served.

$$\frac{\sum [(\text{Number of momentary interruptions})(\text{Number of interrupted customers})]}{\text{Total number of customers}}$$

For 2015, values for the local MAIFI metric in the three IOUs ranged from 0.239 to 9.298.



Statewide Reliability Performance 2006-2015

System wide SAIDI

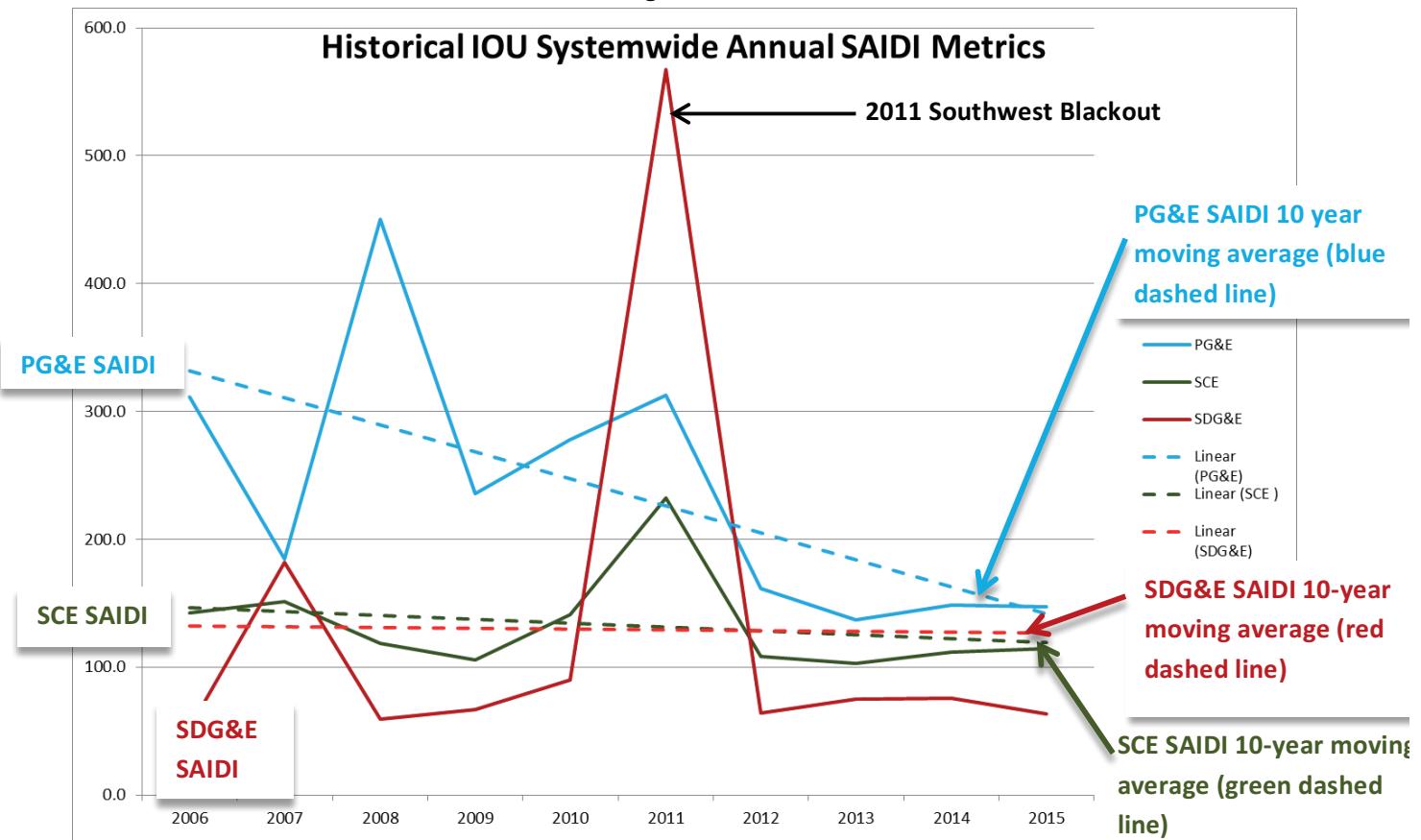
Based on the system wide reliability metrics over the years 2006-2015, overall statewide electric reliability has shown major improvement. With regard to the amount of outage durations as measured by the SAIDI index, Figure 4 shows the annual scores and 10-year moving average for each of the three utilities. For the 10-year moving average, SDG&E and SCE have maintained low averages in the 150 range, with SDG&E holding steady during that time period and SCE reducing its outage duration, with its 10-year moving outage dropping slightly below SDG&E in 2013. Since 2012, SDG&E SAIDI scores have been consistently around 80 minutes, while SCE's scores have hovered slightly above 100.

More notable has been the sharp decline in outage duration in the PG&E system. The 10-year moving average for PG&E has gone from above 300 to where it now is slightly above SDG&E and SCE at 150. Since 2012, PG&E's system-wide SAIDI score has hovered around 150 minutes.

It is also notable that in 2011, the Southern California region, particularly SDG&E service territory, was impacted by a major transmission outage which is reflected in the spike in SAIDI scores for that year. This spike is reflected in the regional scores for SDG&E which are discussed later in this report.



Figure 4



System wide SAIFI

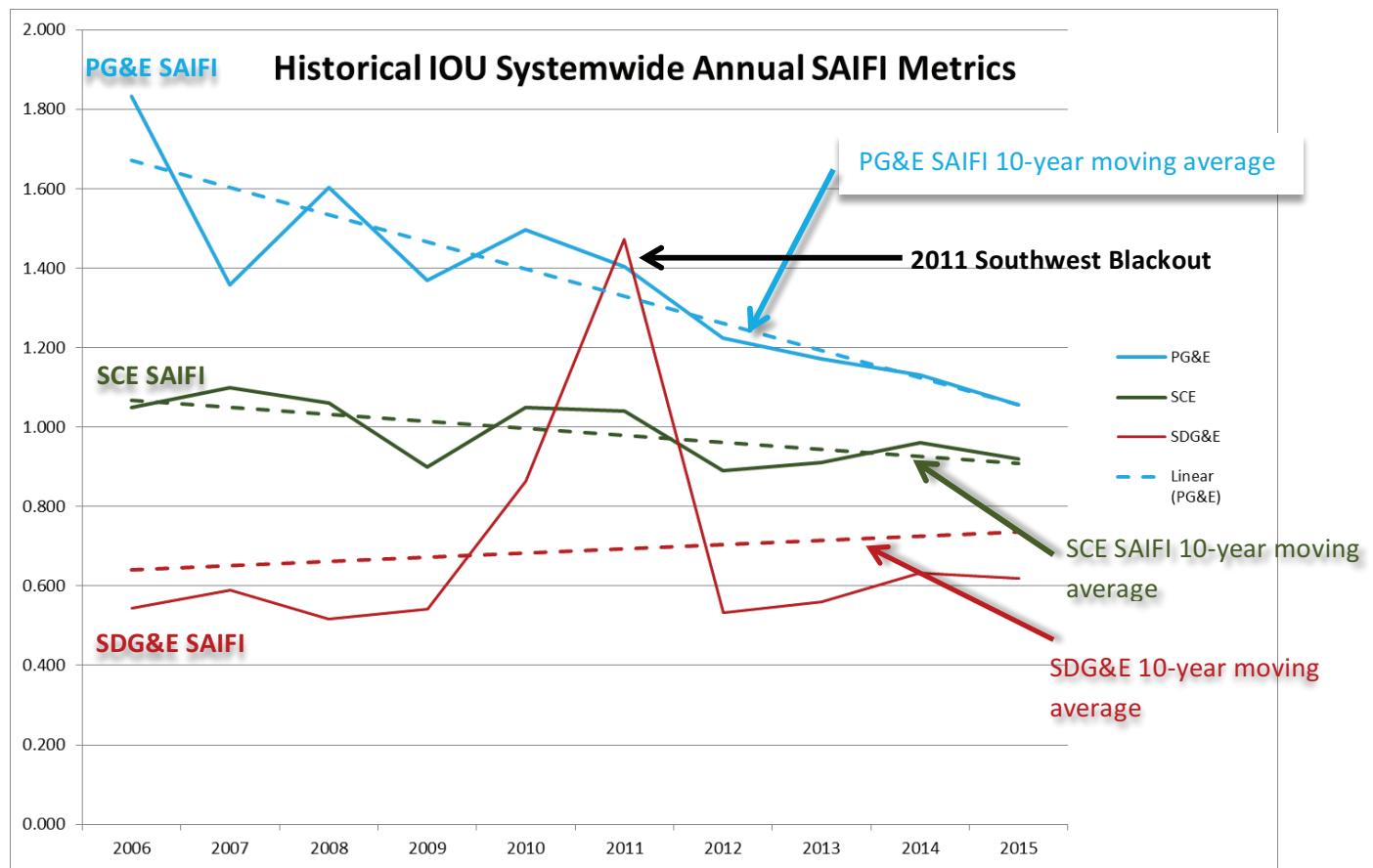
The historical data for outage frequencies as measured by the SAIFI index, shown in figure 5 below, again demonstrates overall improvement in the reliability of California's investor-owned electric systems. SDG&E has the lowest 10-year moving average, thought it has slightly increased during the time period of interest. Prior to 2011, SDG&E's SAIFI score was below 0.6 and since 2013 it has been slightly over that mark, which is still the lowest of the three IOUs.

SCE has shown steady improvement over the past ten years, where early in that period, SCE's SAIFI scores hovered near 1.1, more recent scores have been in the 0.9 range.

Similar to its SAIDI scores, PG&E has a significant drop in SAIFI scores. Where it had been considerably higher than the other two large IOU electric services early in the reviewed period, it has dropped steadily and is approaching SCE, with a 2015 system wide SAIFI score of 1.05.



Figure 5

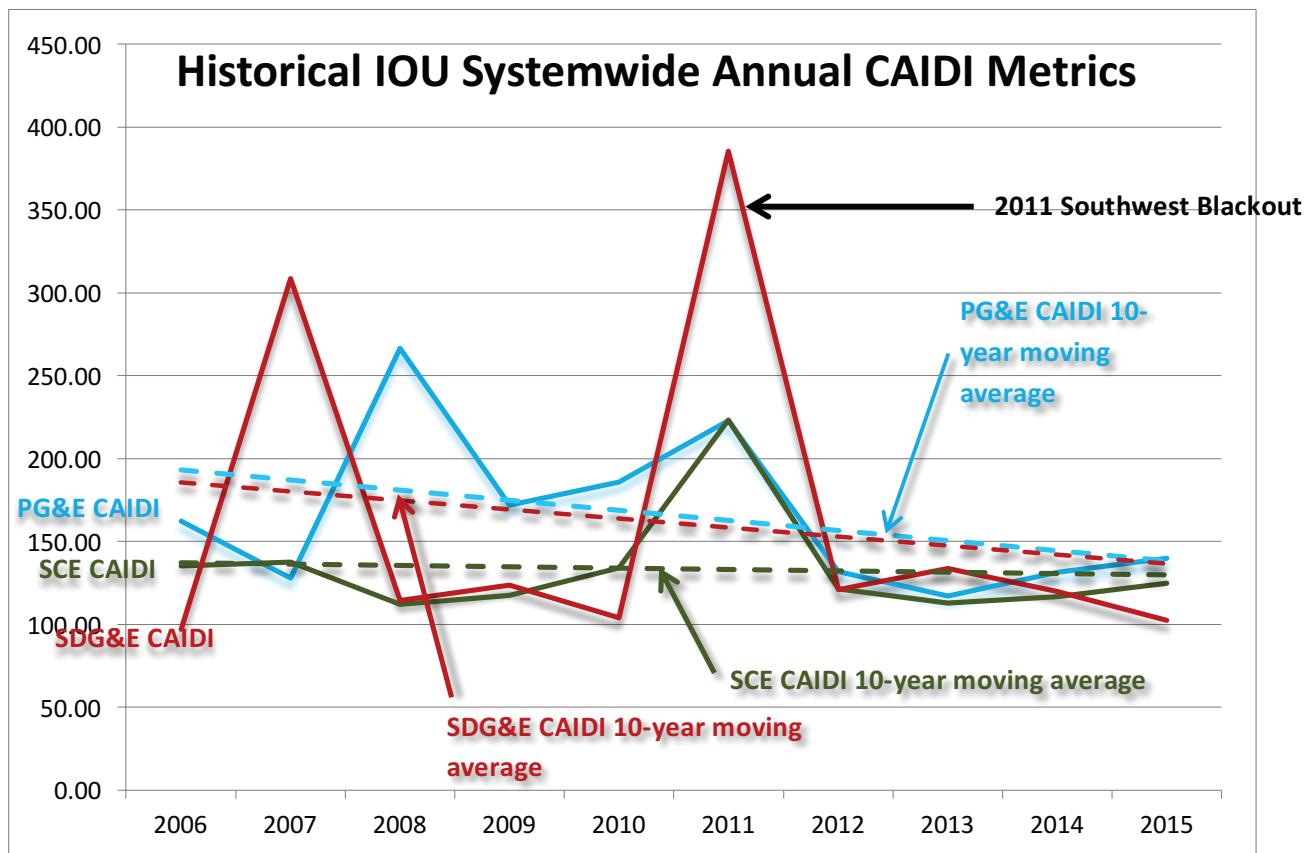


System wide CAIDI

For historical system wide annual CAIDI scores as shown in Figure 6 below, the results differ somewhat from the prior two metrics. For CAIDI, historically SCE has been the lowest scorer, with a relatively flat 10-year moving average at approximately 130. SDG&E and PG&E have both had higher scores and 10-year moving averages, but both utilities' averages have dropped steady and in the past three years, all three utilities have had similar CAIDI scores, ranging from 100-140 last year.



Figure 6

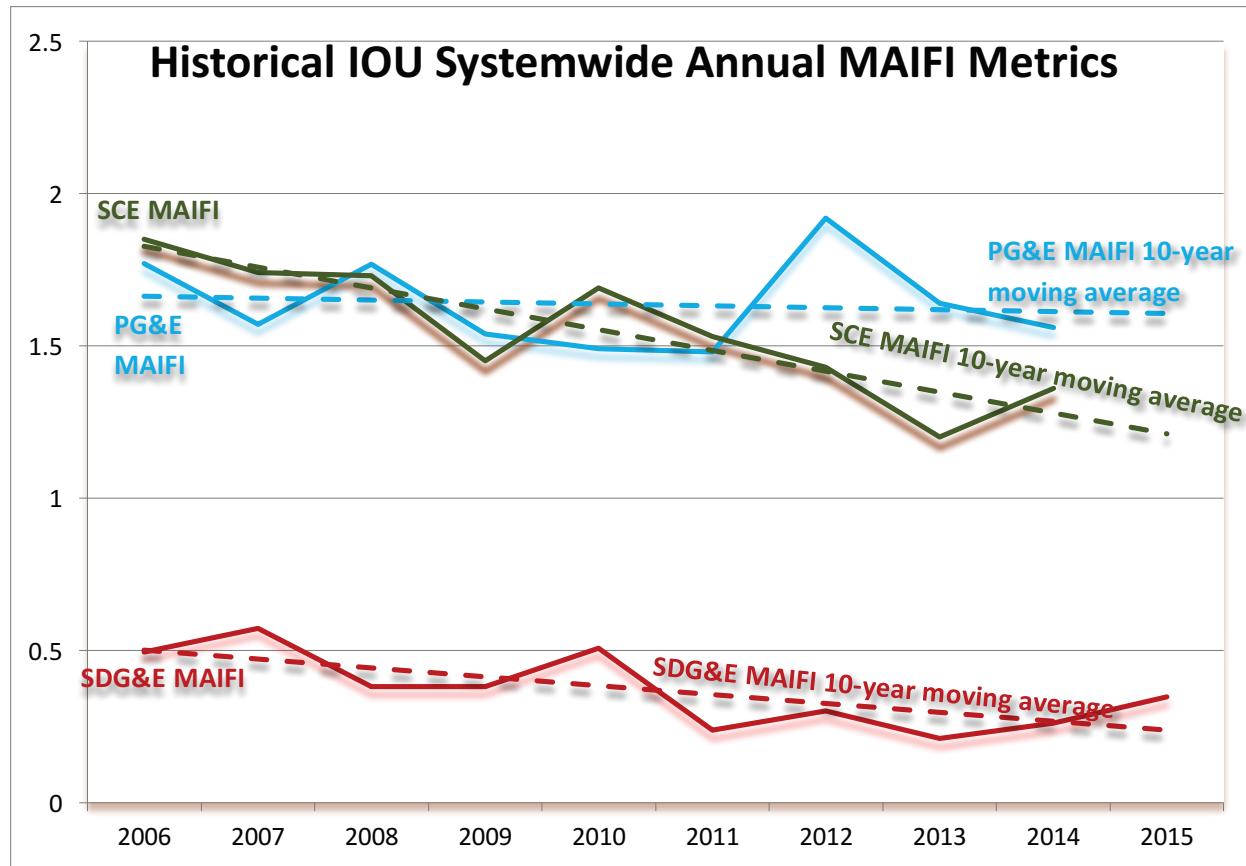


System wide MAIFI

Figure 7 below provides the historic system wide annual MAIFI scores. The results for system-wide annual MAIFI scores differs from the previous metrics with SDG&E having scores that are 25-33% of SCE and PG&E scores. SDG&E has shown steady improvement over the past 10 years. SCE has also shown a steady decline in momentary outages, with the MAIFI score starting at 1.75 and dropping to as low as 1.25 in recent years. PG&E MAIFI scores started in the same range as SCE, but has only slightly declined based on the 10 year moving average and actually spiked in 2012 at 1.9, the highest frequency of momentary outages of any California IOU electric system over the past ten years.



Figure 7





Regional Reliability Review 2006-2015

In this section, annual reliability metrics are described by utility division or district. This information is grouped by region to provide a distinct portrait of reliability with meaningful insight into electric service performance at a local level.

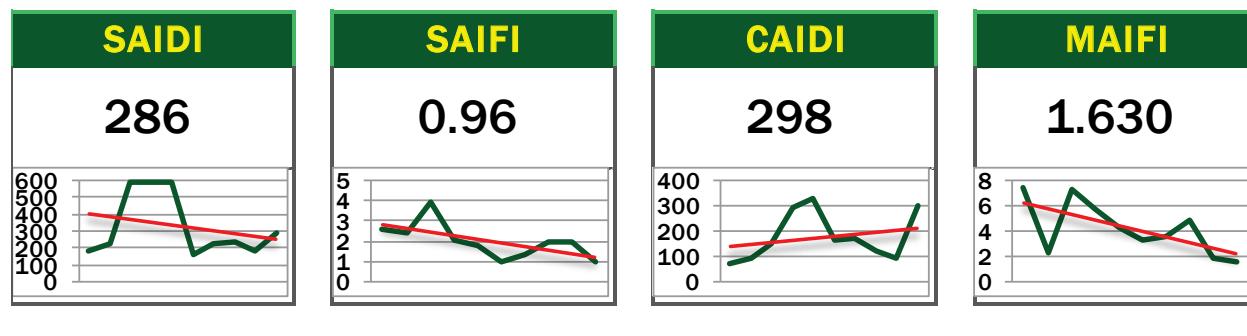
Reliability Dashboards

This report presents reliability metrics utilizing a dashboard that is designed to convey information on reliability for each division or district based on the data provided by each utility. An example of the reliability dashboard is shown below in Figure 8.

Figure 8

California Reliability Dashboard Example

SCE Central Valley - Kernville District



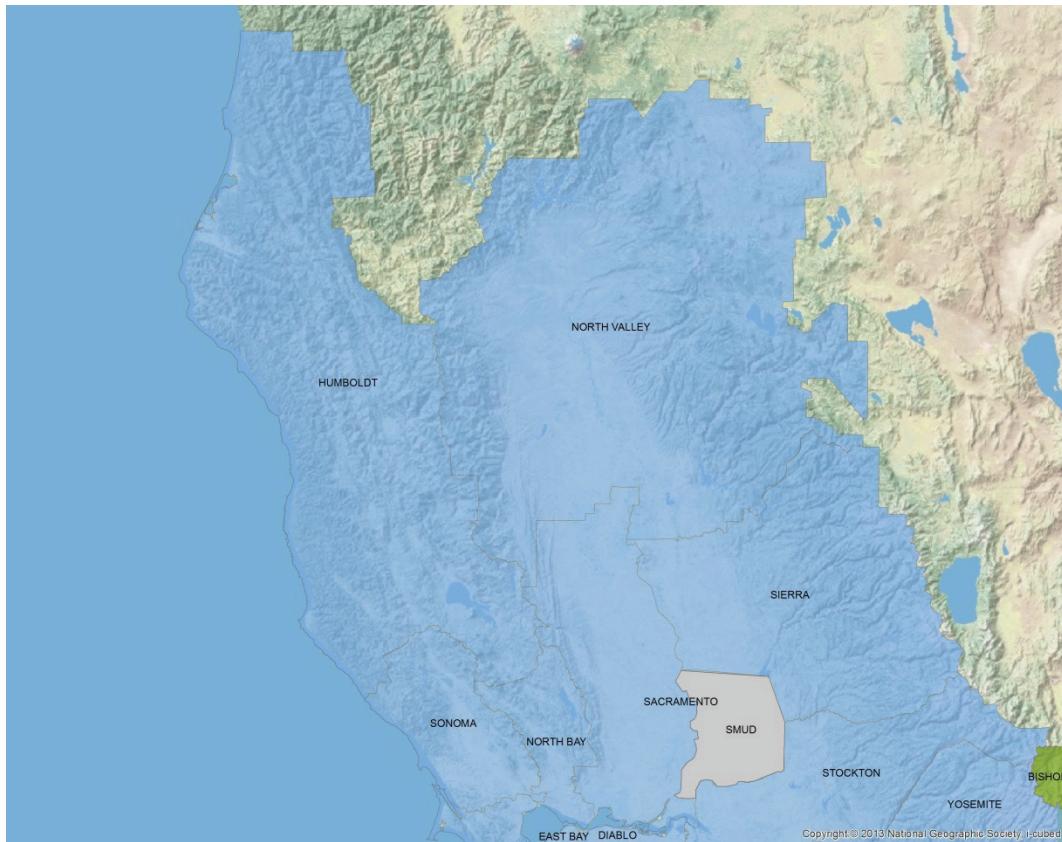
The four reliability metrics are highlighted in the dashboard. The metric for the current reporting year, 2015, is listed on the top of each metric square; the color of the banner is dependent on the utility being highlighted, blue for PG&E, green for SCE, and red for SDG&E. Below the metrics are colored graphs that indicate that metrics performance over the past ten years; the red line is a 10-year moving average for that metric. A moving average that slopes down from left to right indicates that reliability has improved based on annual metric scores over the past ten years. A flat line indicates that reliability has been stable over those years. A line that slopes upward from left to right indicates that reliability has decreased during that time period. The dark line shows how that metric has performed annually over the ten year history and indicates whether that index has been consistent on a year-to-year basis, has frequent spikes and dips or had prior years of higher or lower values for that index.

In the above example, the SAIDI graph shows that SAIDI in the first five years had scores up to 600. Since that time, the SAIDI score has been in the 250 to 300 range including the current score of 286. The 10-year moving average shows a decline in SAIDI which indicates fewer outage minutes in recent years when compared with the earlier period. Similarly, in the above example, the SAIFI index shows an early spike and then some variability in a lower range, with the 2015 value of 0.96 being on the lower end of that range. In contrast, the CAIDI index shows the 10-year moving average increasing for this index. Finally, the MAIFI index shows significant variability over the past 10 years, trending downward, with the 2015 score of 1.630 being the lowest for that period.



Northern Region

Figure 9
Northern Region

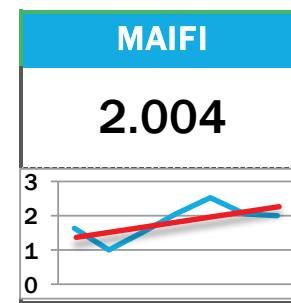
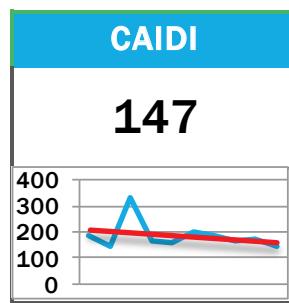
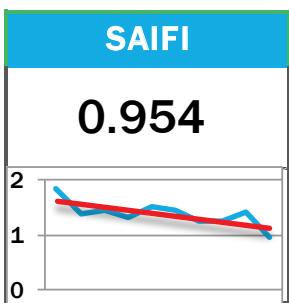
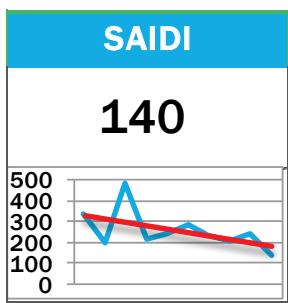


Regional Summary

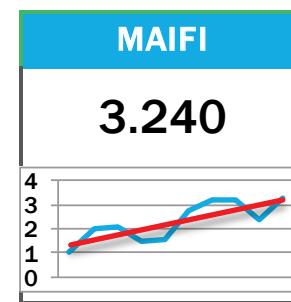
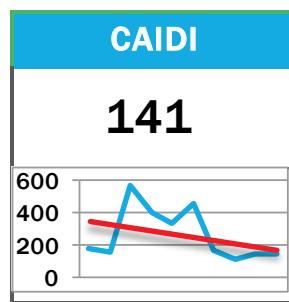
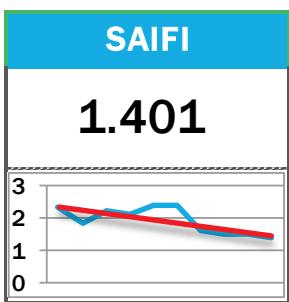
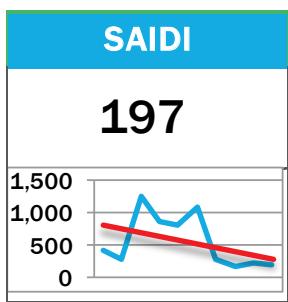
The Northern Region consists of PG&E divisions Sierra, Humboldt and Sonoma. All three divisions have shown improvement in reliability. In 2015, Sonoma had the lowest score for the region at 140, indicating the best reliability performance in the region, while Humboldt had a high score of 741 for 2015. All three divisions show significant improvement with reduced outage duration, with SAIDI scores trending lower and a sharp drop in SAIDI scores between 2012 and 2013. The frequency of outages on an annual basis also declined, with SAIFI showing improvement and scores trending downward over the period. However, momentary outages trended upward slightly in all three divisions.



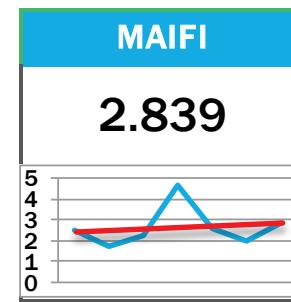
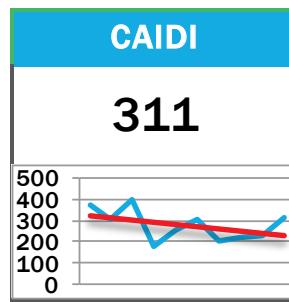
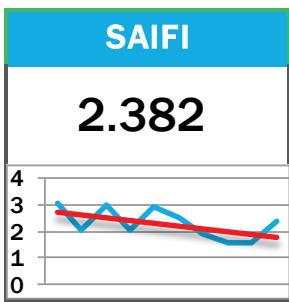
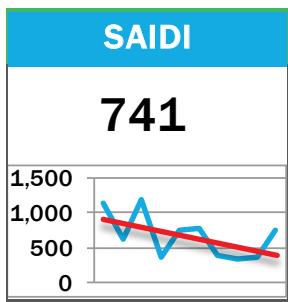
PG&E Northern Region - Sonoma Division



PG&E Northern Region - Sierra Division



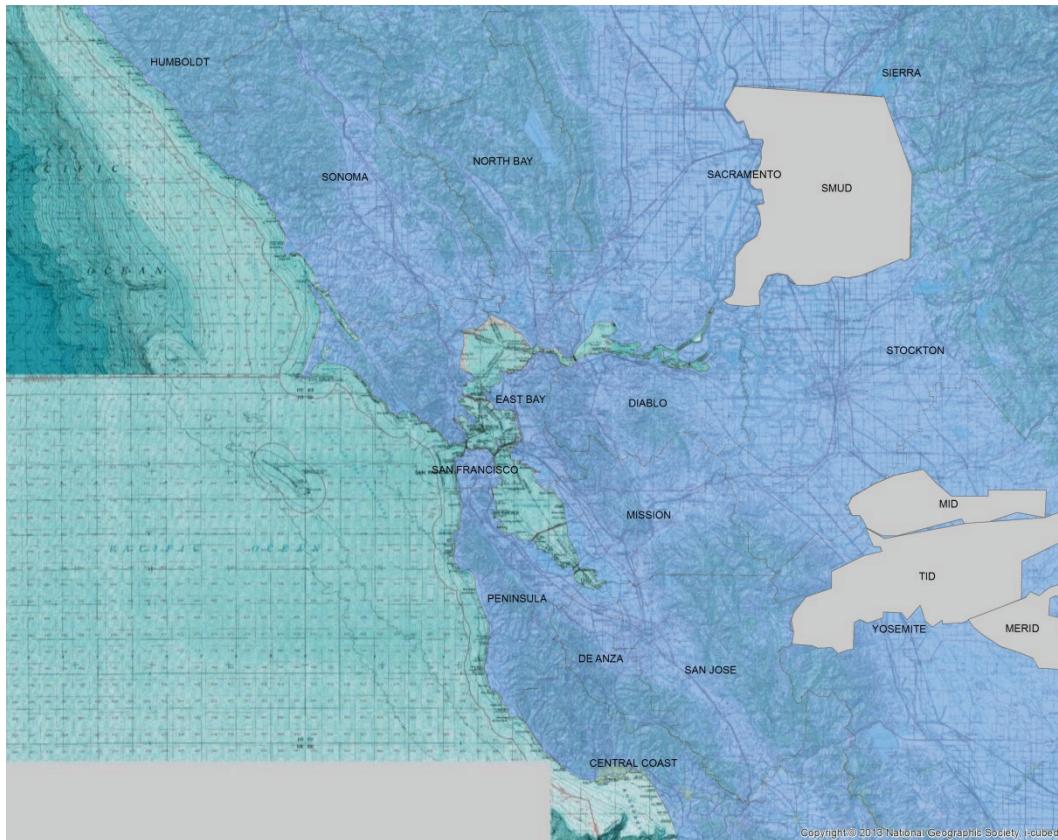
PG&E Northern Region - Humboldt Division





Bay Area Region

Figure 10
Bay Area Region



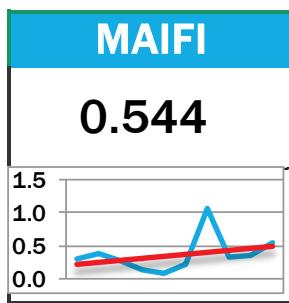
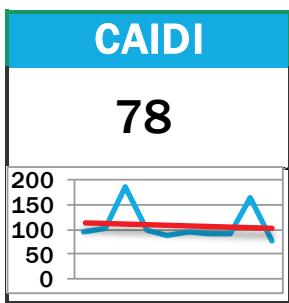
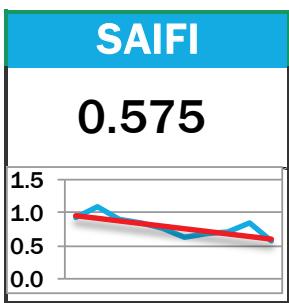
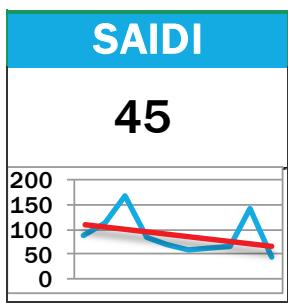
Regional Summary

The Bay Area consists of eight PG&E divisions, 1) North Bay, 2) San Francisco, 3) East Bay, 4) Diablo, 5) Mission, 6) Peninsula, 7) De Anza, and 8) San Jose. Within PG&E's service territory, overall the Bay Area has seen significant improvement in reliability over the past ten years. Both outage duration and frequency trended downward over the past ten years, with some divisions showing marked improvement since 2012. Some divisions have also shown a decline in momentary outages. The division dashboard that follows has the Bay Area divisions ranked by their SAIDI score, from lowest to highest.

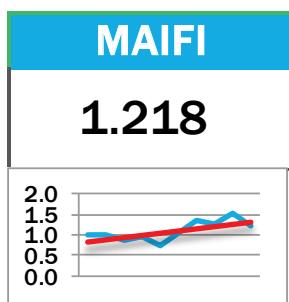
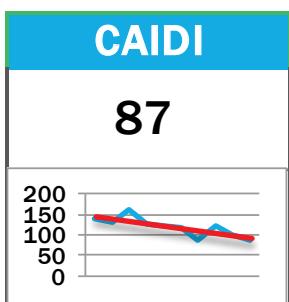
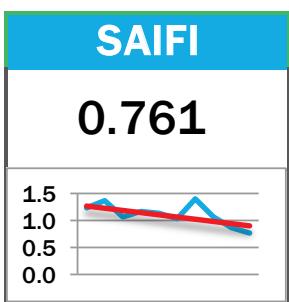
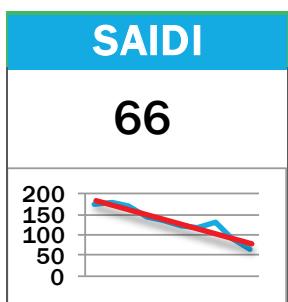
With regard to division reliability performance, all divisions showed improved for the past ten years except for San Francisco, which has had a spike in outage duration in 2014.



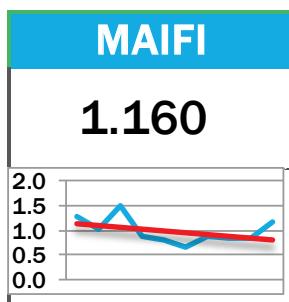
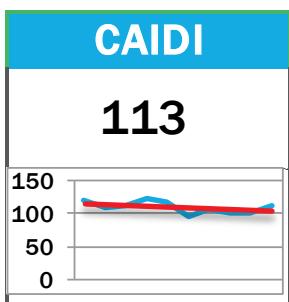
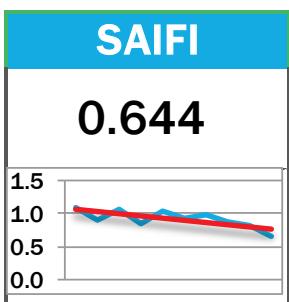
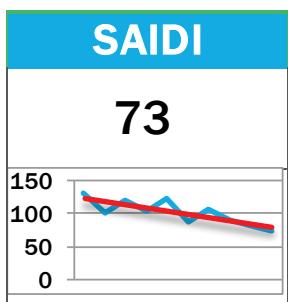
PG&E Bay Area - San Francisco Division



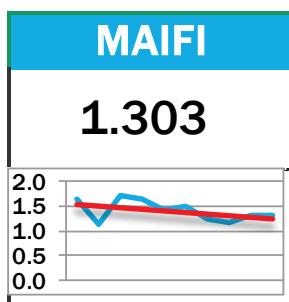
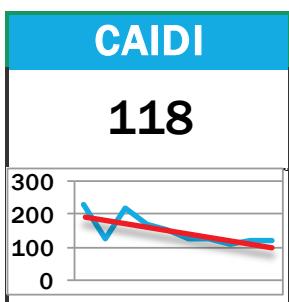
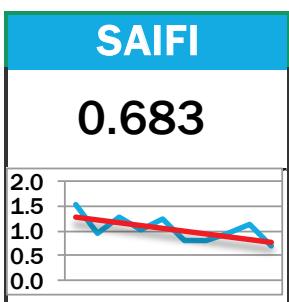
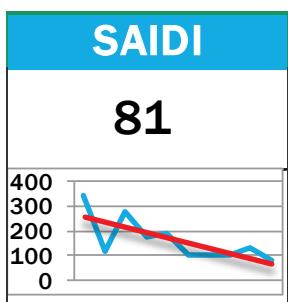
PG&E Bay Area - East Bay Division



PG&E Bay Area - Mission Division

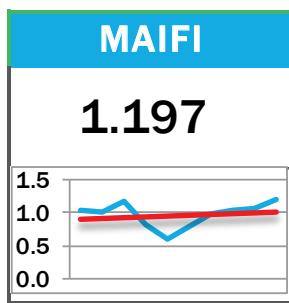
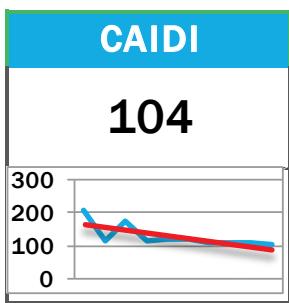
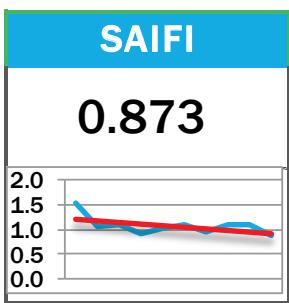


PG&E Bay Area - De Anza Division

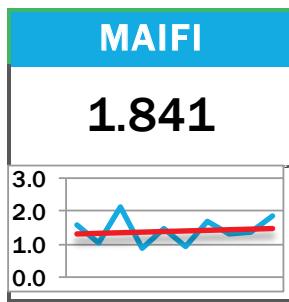
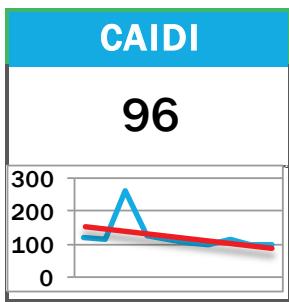
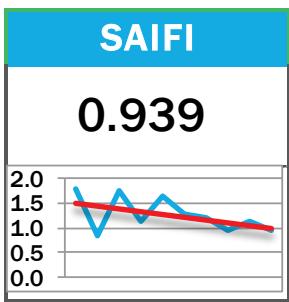
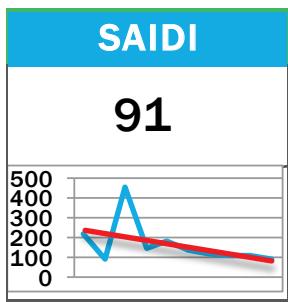




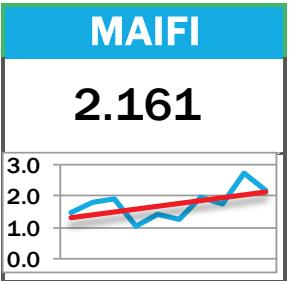
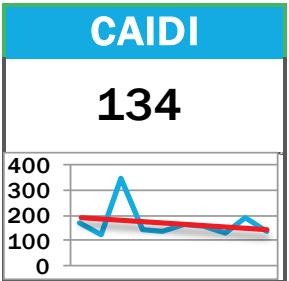
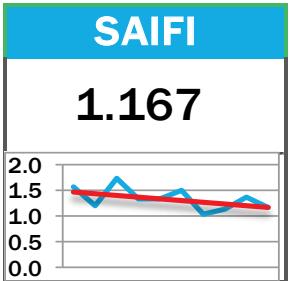
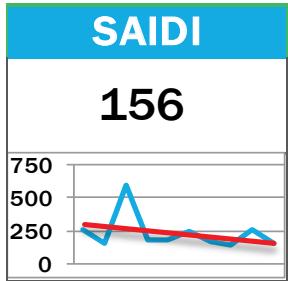
PG&E Bay Area - San Jose Division



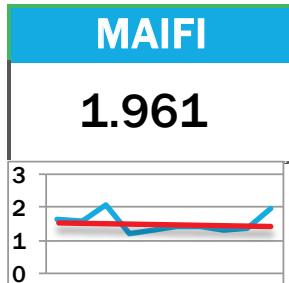
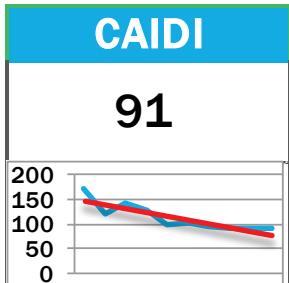
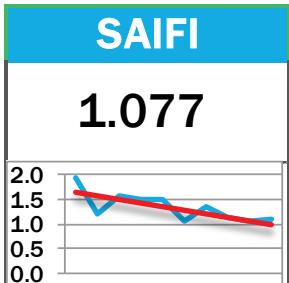
PG&E Bay Area - Peninsula Division



PG&E Bay Area - North Bay Division



PG&E Bay Area - Diablo Division





Central Valley Region

Figure 11
Central Valley Region

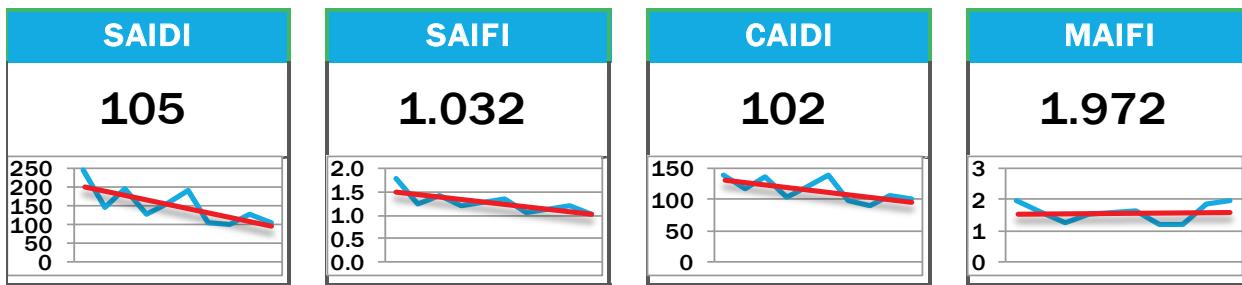


Regional Summary

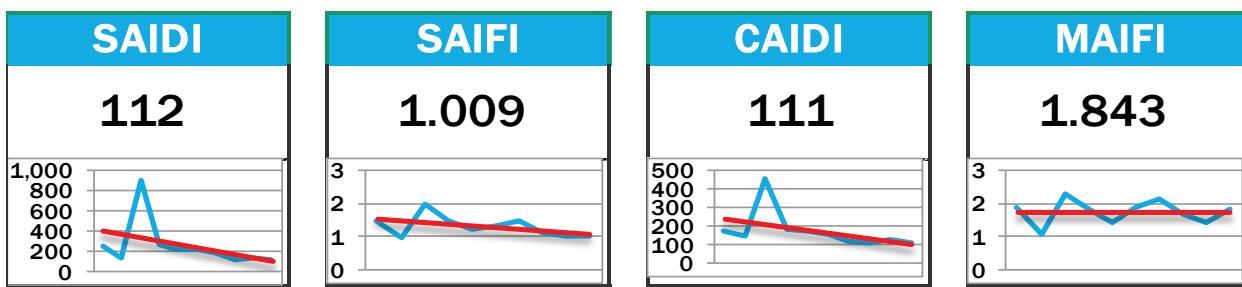
The Central Valley Region is unique because it is a combination of PG&E divisions and SCE districts. It consists of six PG&E divisions and three SCE districts. The PG&E divisions in the Central Valley region are 1) North Valley, 2) Sacramento, 3) Stockton, 4) Yosemite, 5) Fresno, and 6) Kern. The SCE districts are Kernville, San Joaquin, and Tehachapi. In general, eight of the nine divisions or districts showed positive improvement in reliability. The exception was SCE San Joaquin District which showed an increase in SAIDI annual results over the ten year period. The remaining eight did show notable improvement, particularly the PG&E's Fresno and Sacramento divisions along with SCE Kernville and Tehachapi districts.



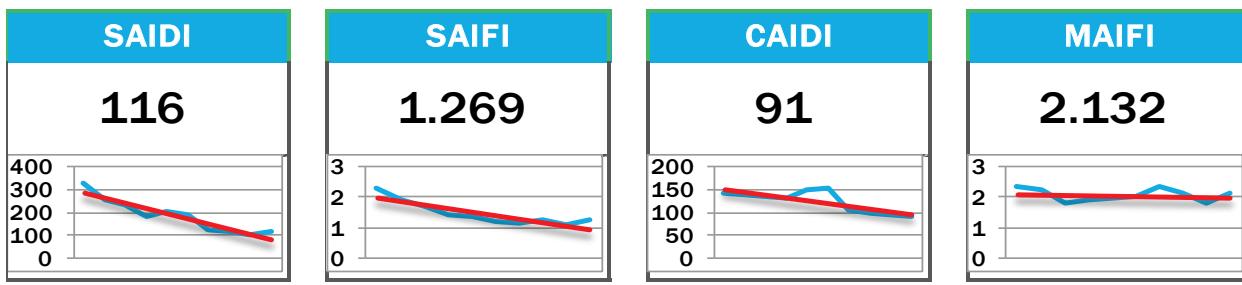
PG&E Central Valley - Kern Division



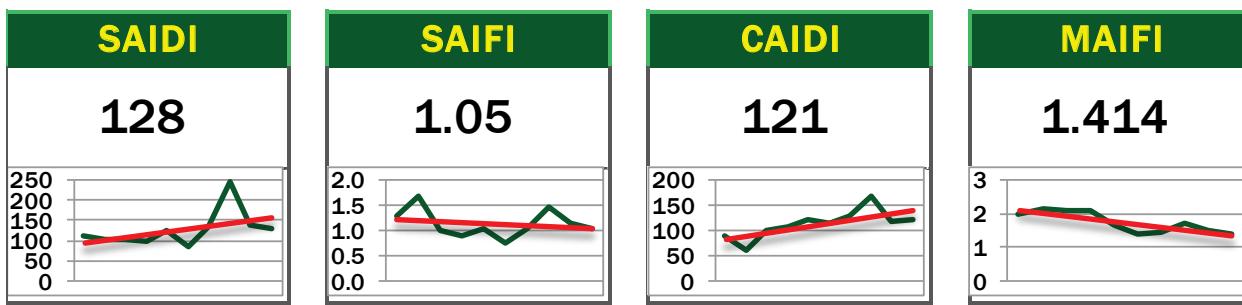
PG&E Central Valley - Sacramento Division



PG&E Central Valley - Fresno Division



SCE Central Valley - San Joaquin District





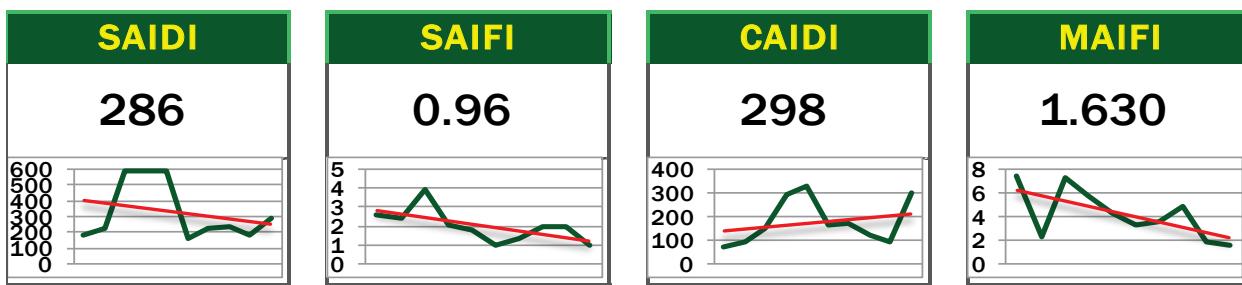
PG&E Central Valley - Yosemite Division



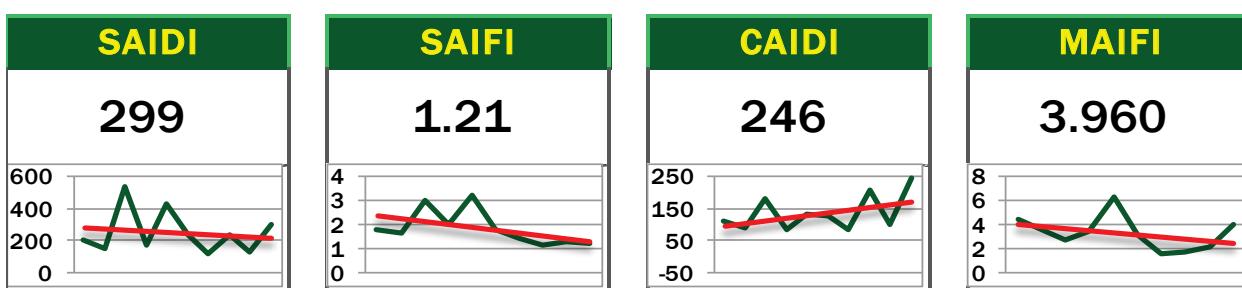
PG&E Central Valley - Stockton Division



SCE Central Valley - Kernville District

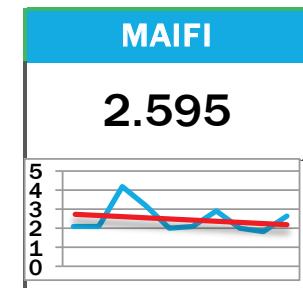
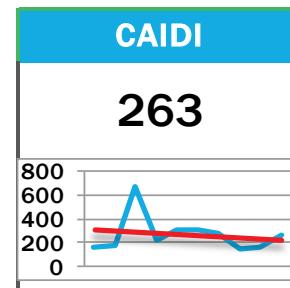
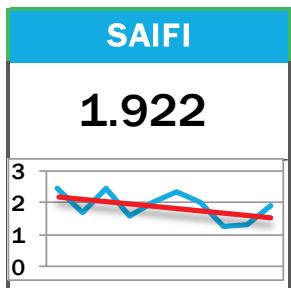
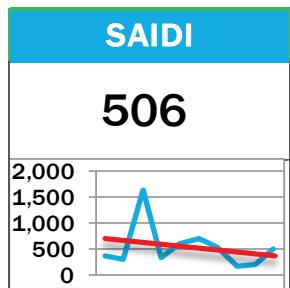


SCE Central Valley - Tehachapi District





PG&E Central Valley - North Valley Division





Coastal Region

Figure 12
Coastal Region

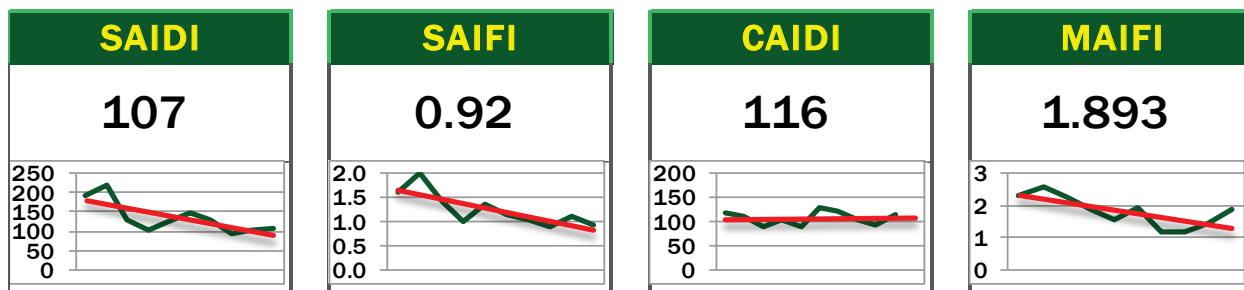


Regional Summary

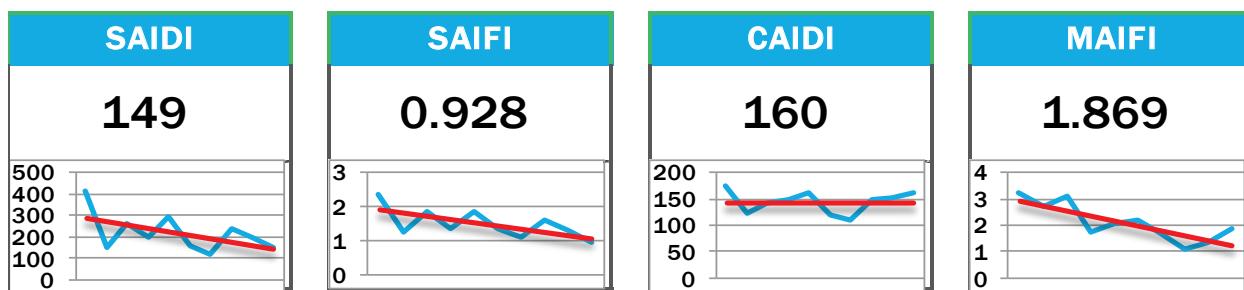
The Coastal region is a mix of two PG&E divisions and three SCE districts. The PG&E divisions are Central Coast and Los Padres; the SCE districts are 1) Santa Barbara, 2) Thousand Oaks, and 3) Ventura. All five showed improvements in reliability in the past ten years with notable reduction in outage durations and frequency. Most metrics improved or held steady, with the exception of Ventura District where CAIDI scores slightly trended upwards.



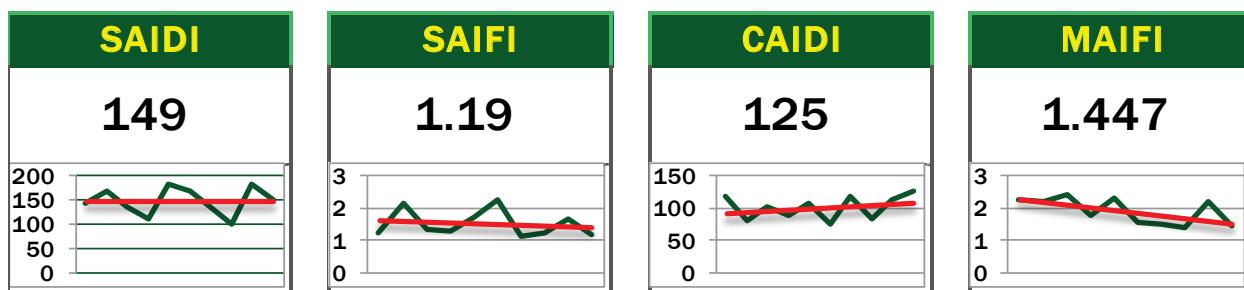
SCE Coastal - Thousand Oaks District



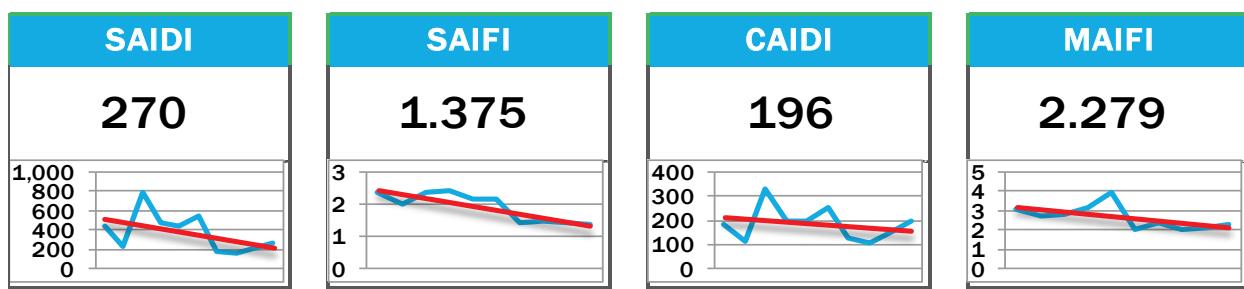
PG&E Coastal - Los Padres Division



SCE Coastal SoCal - Ventura District

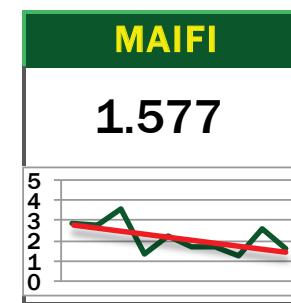
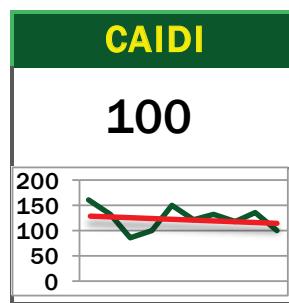
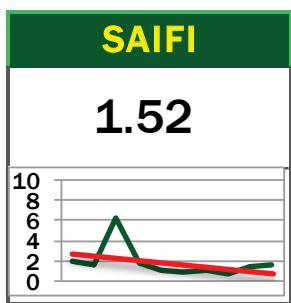
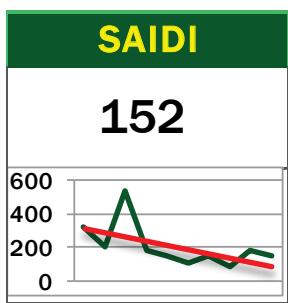


PG&E Coastal - Central Coast Division





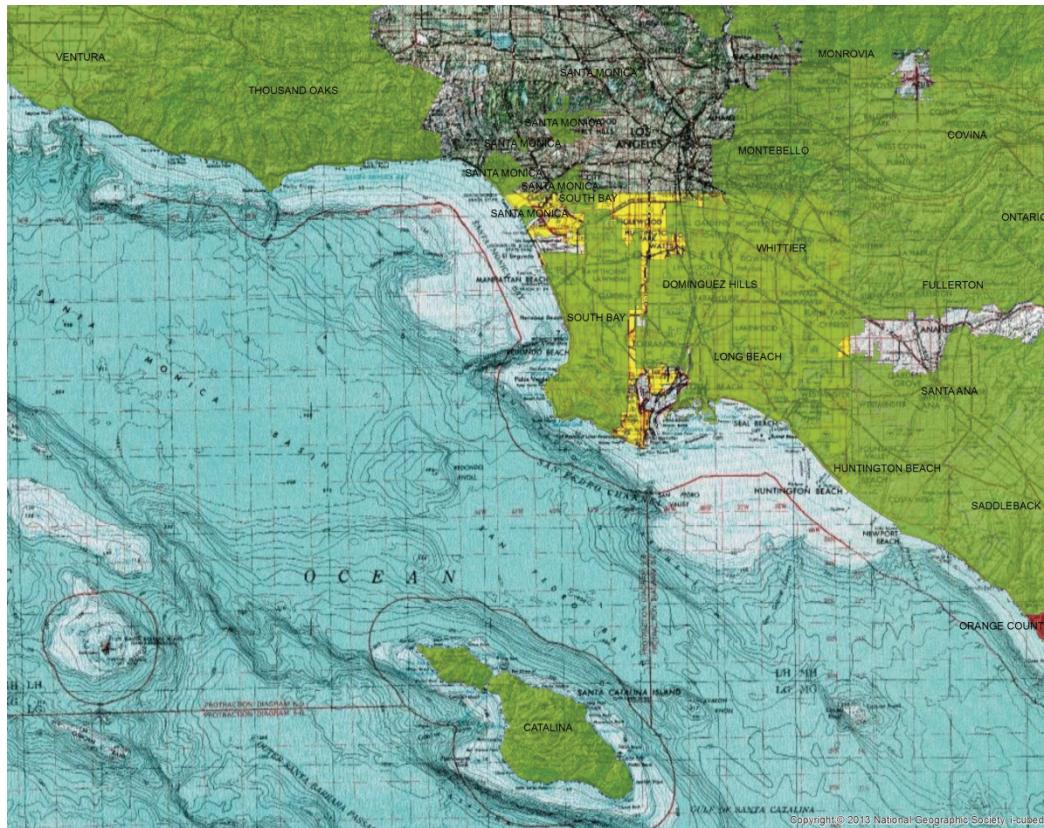
SCE Coastal - Santa Barbara District





Los Angeles County (West) Region

Figure 13
Los Angeles County (West) Region

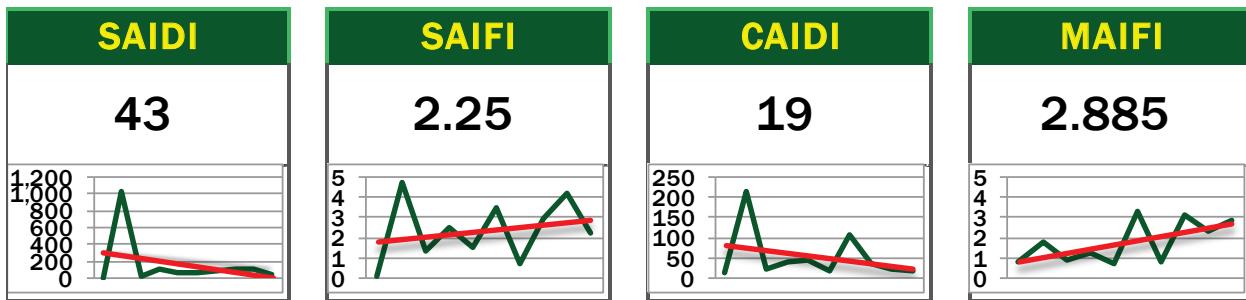


Regional Summary

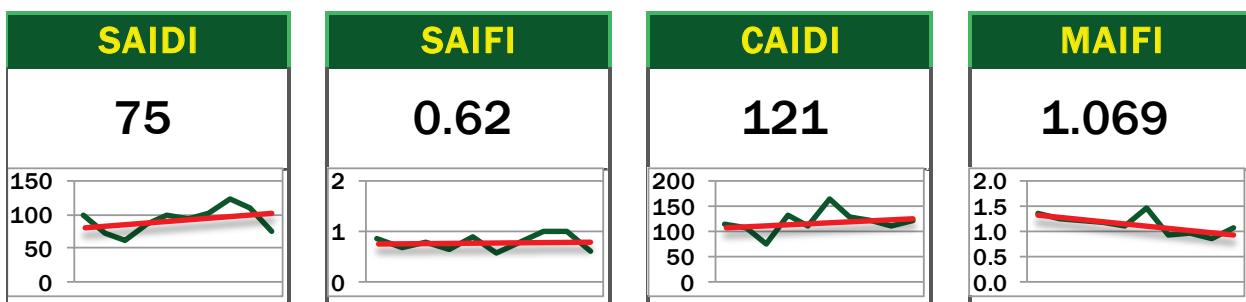
The Los Angeles County (West) Region consists of five SCE districts, 1) Catalina, 2) Santa Monica, 3) Dominguez Hills, 4) South Bay and 5) Long Beach . This region had a majority of districts where reliability has decreased in the State. In particular, the reliability metrics for South Bay, Long Beach and Santa Monica Districts indicate a decline in performance. In contrast, Catalina District had notable improvement although it, Long Beach, and Dominguez Hills had increased MAIFI scores.



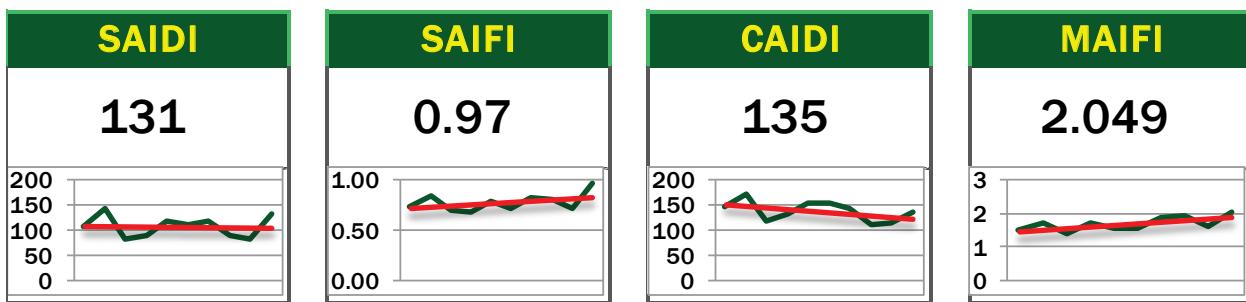
SCE Los Angeles County West - Catalina District



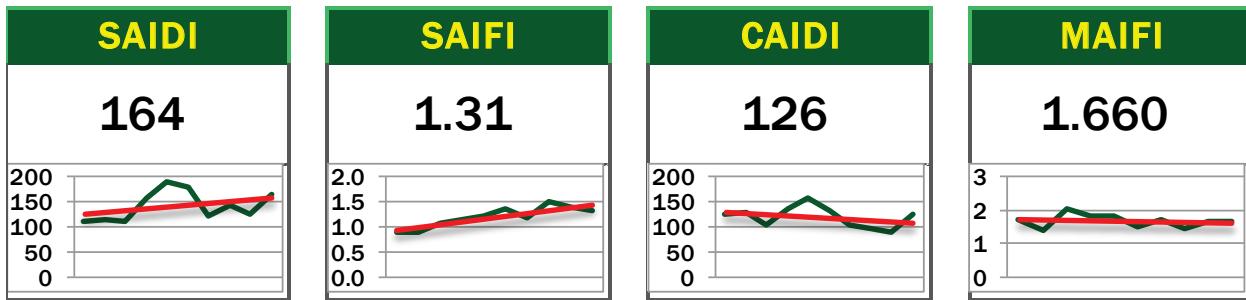
SCE Los Angeles County West - Santa Monica District



SCE Los Angeles County West - Dominguez Hills District

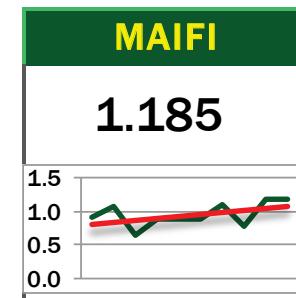
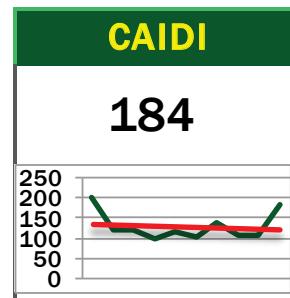
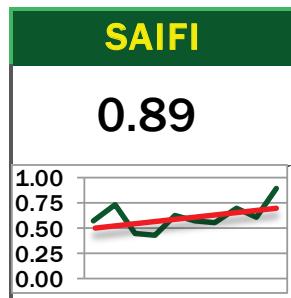
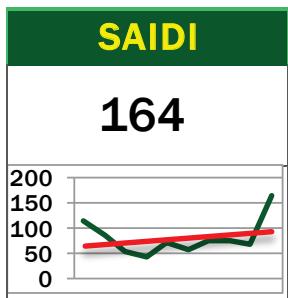


SCE Los Angeles County West - South Bay District





SCE Los Angeles County West - Long Beach District





Los Angeles County (East) Region

Figure 14
Los Angeles County (East) Region

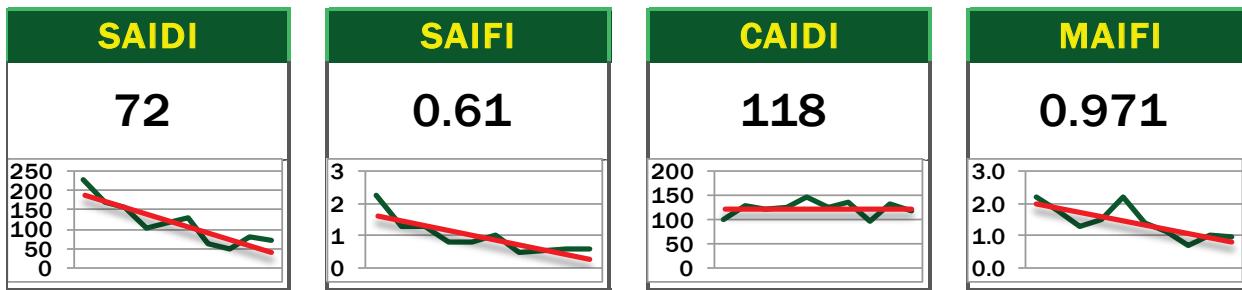


Regional Summary

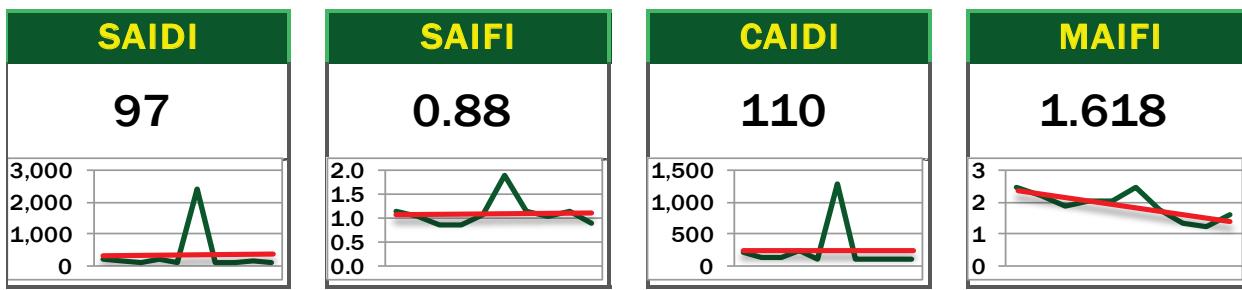
Los Angeles County (East) consists of six SCE districts where the majority of districts had failing reliability performance over the past ten years. These districts are 1) Antelope Valley, 2) Covina, 3) Foothill, 4) Monrovia, 5) Montebello, 6) Valencia, and 7) Whittier. The Valencia district showed notable improvement, the remaining five districts either had marginal improvement or a decline in performance over the past ten years. The historical metrics indicates that these trends reflect the impact of the 2011 regional transmission outage on these districts.



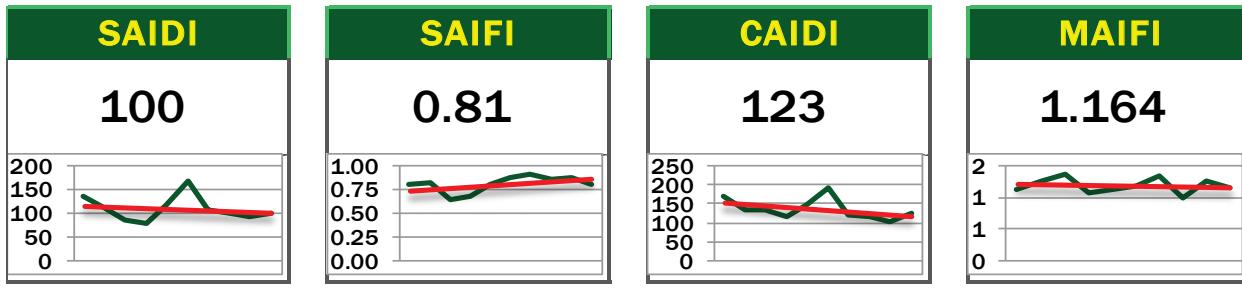
SCE Los Angeles County East - Valencia District



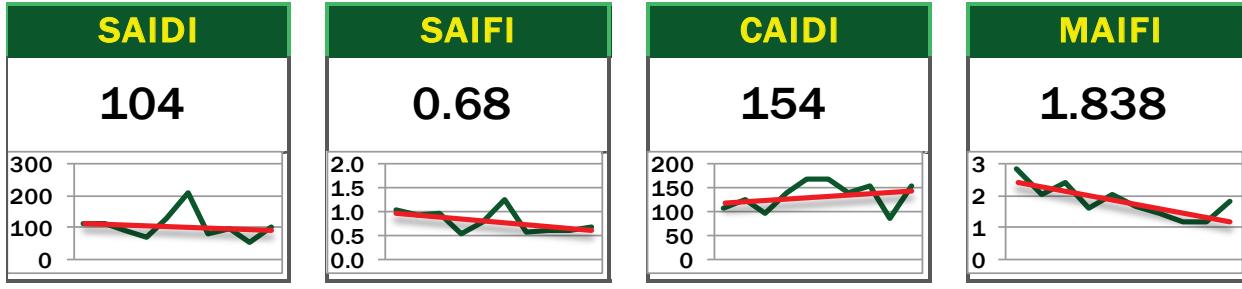
SCE Los Angeles County East - Monrovia District



SCE Los Angeles County East - Covina District

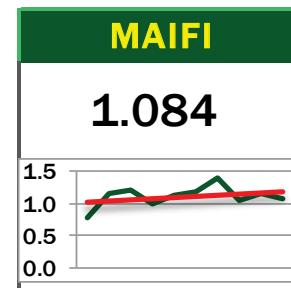
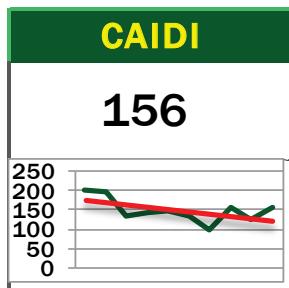
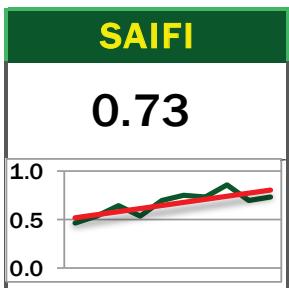
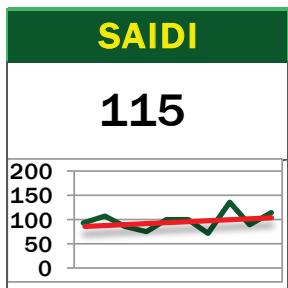


SCE Los Angeles County East - Antelope Valley

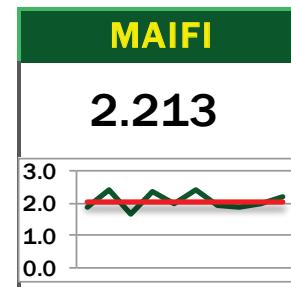
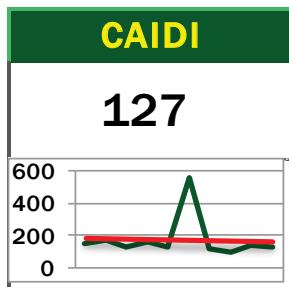
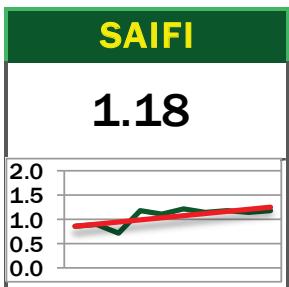
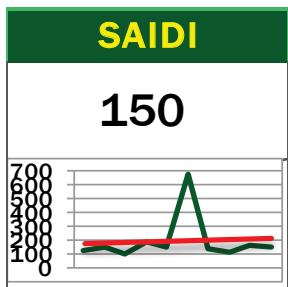




SCE Los Angeles County East - Whittier District



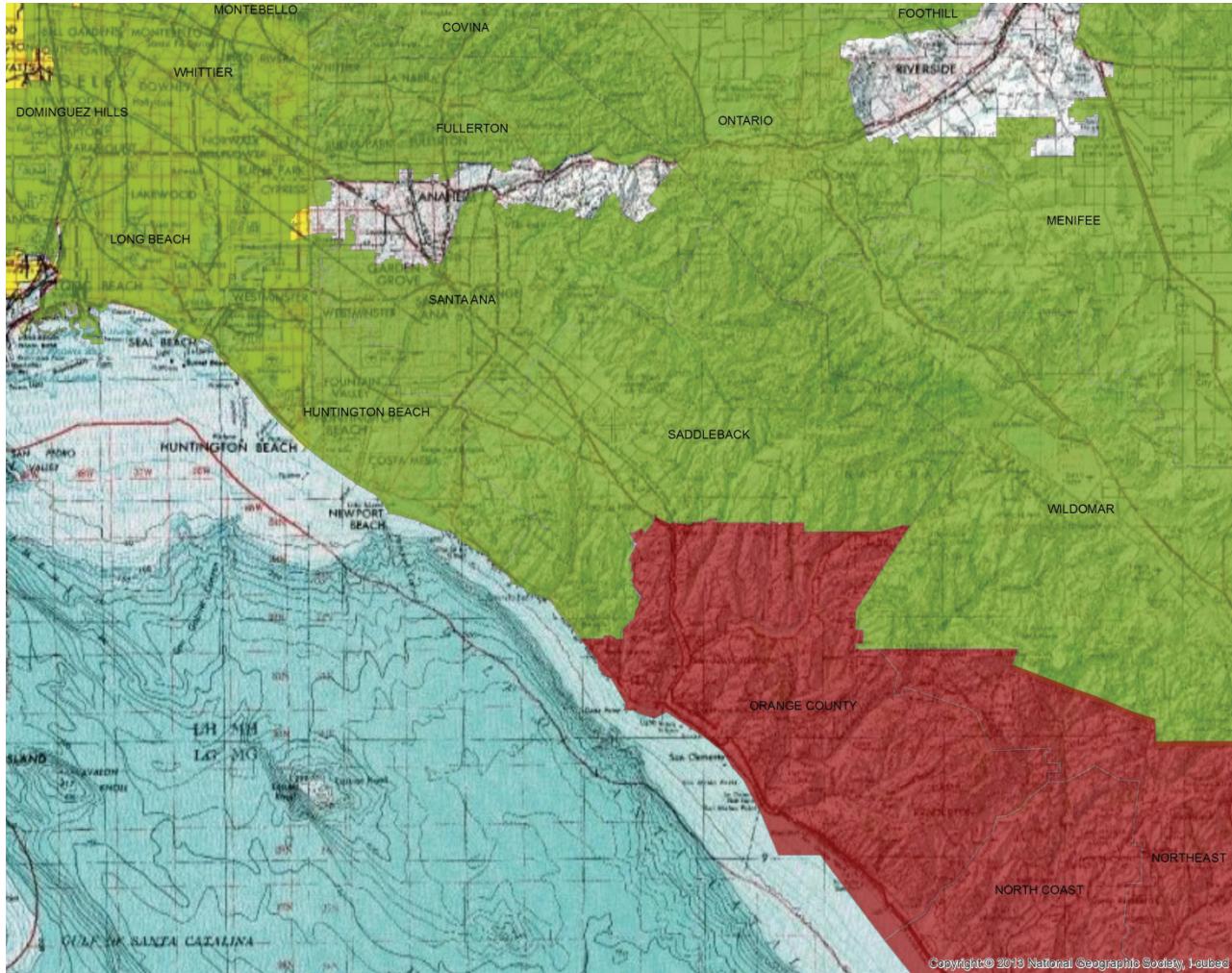
SCE Los Angeles County East - Montebello District





Orange County Region

Figure 15
Orange County Region

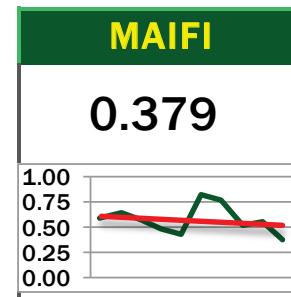
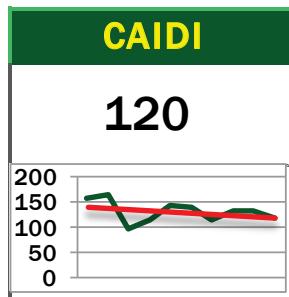
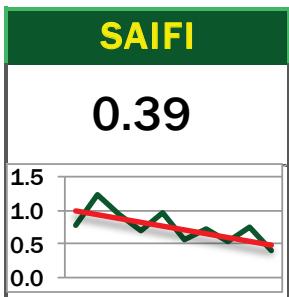
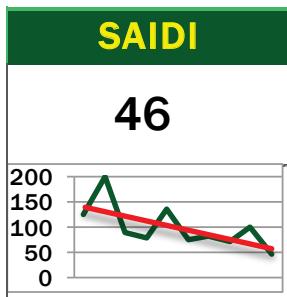


Regional Summary

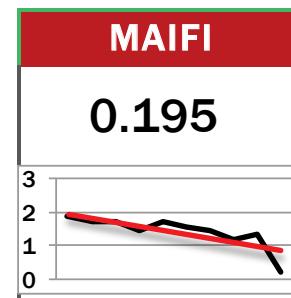
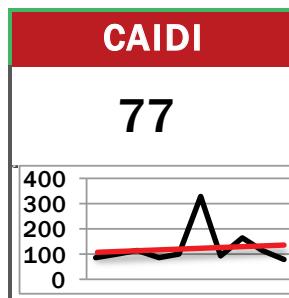
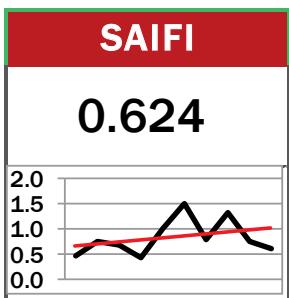
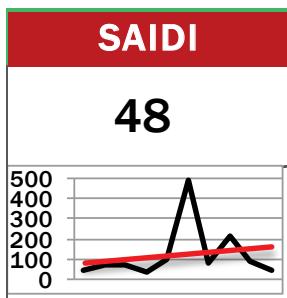
Orange County consists of four SCE districts and one SDG&E district. The SDG&E district is Orange County. The four SCE districts are 1) Fullerton, 2) Huntington Beach, 3) Saddleback, and 4) Santa Ana. The four SCE districts showed improvement in reliability but the SCDG&E Orange County District did show a decline in reliability, primarily due to the 2011 regional transmission outage. It should be noted that it had a 2015 SAIDI score of 48, with the region top score being 46 from the Saddleback District. All districts have low outage durations compared to other parts of the state.



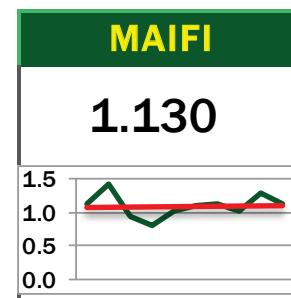
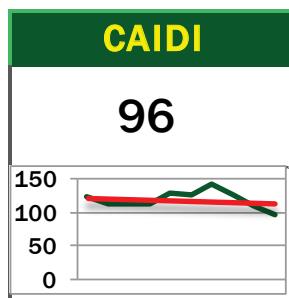
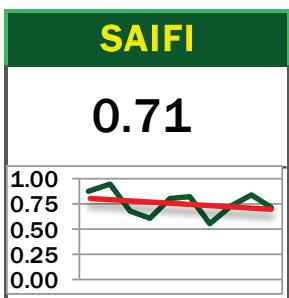
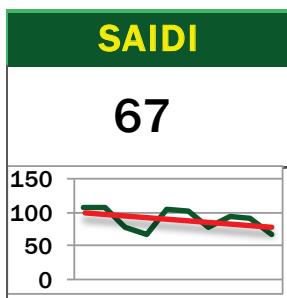
SCE Orange County - Saddleback District



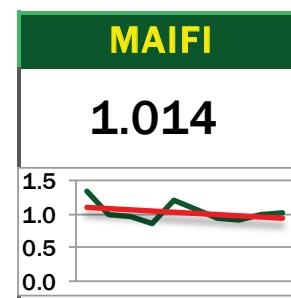
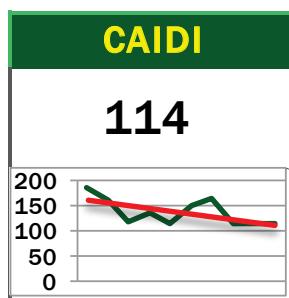
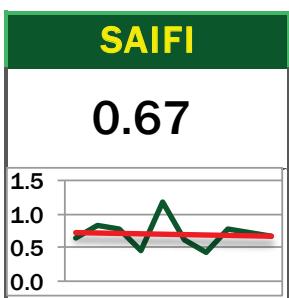
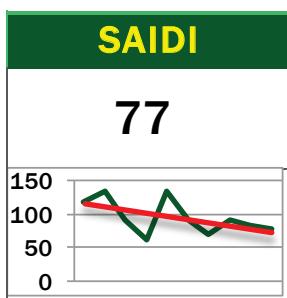
SDG&E Orange County - Orange County District



SCE Orange County - Santa Ana District

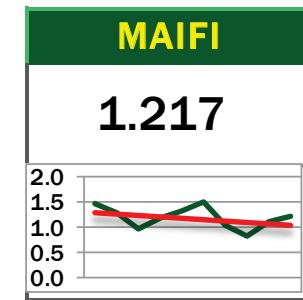
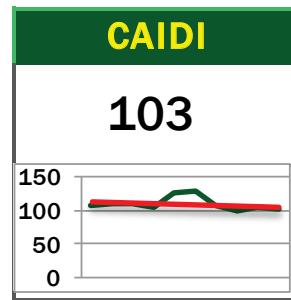
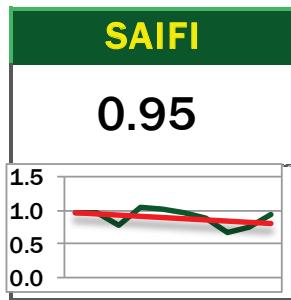
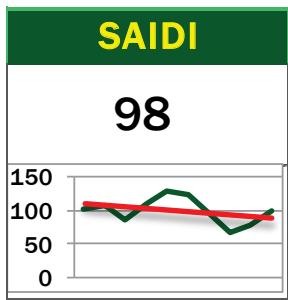


SCE Orange County - Fullerton District





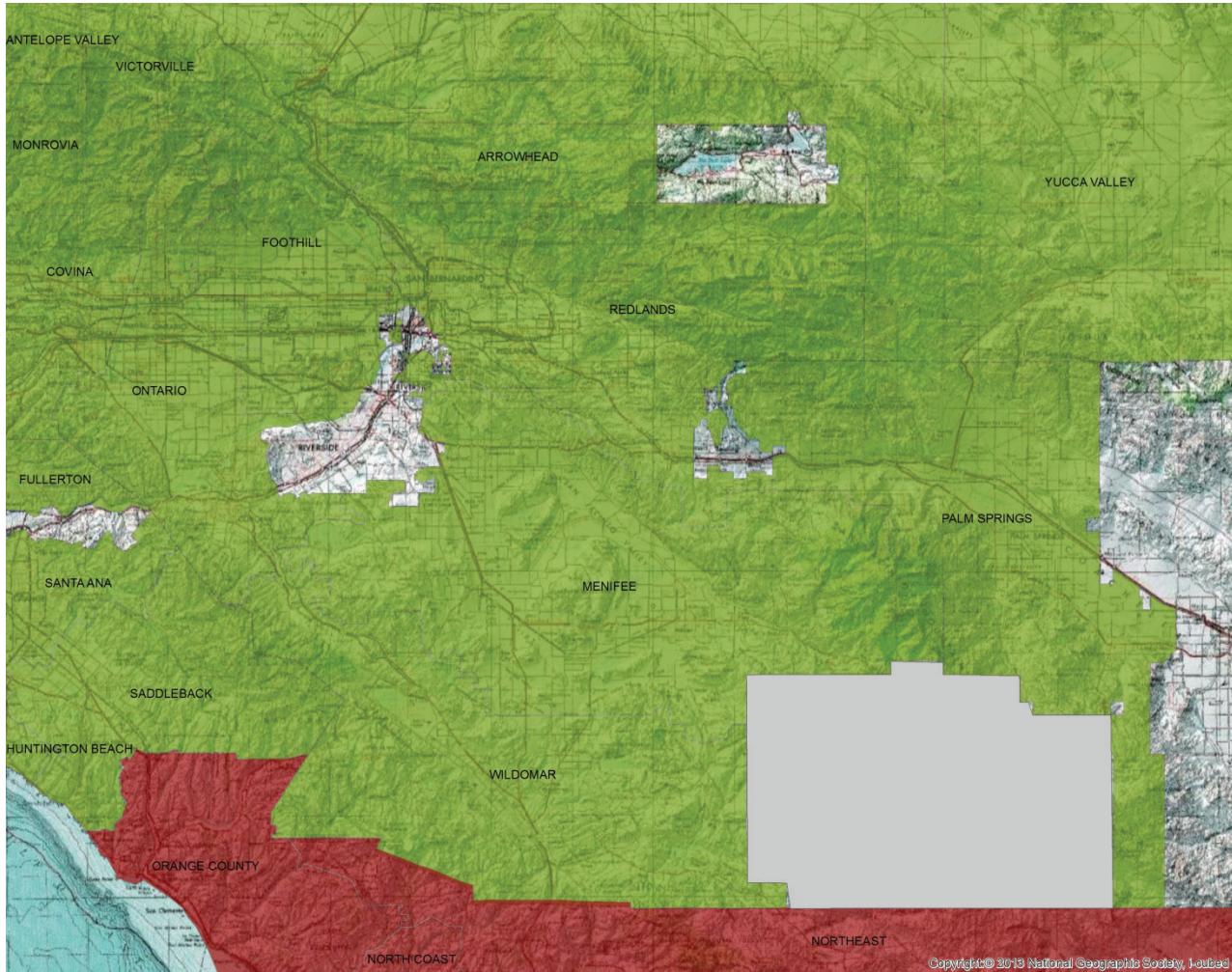
SCE Orange County - Huntington Beach District





Inland Empire Region

Figure 16
Inland Empire Region

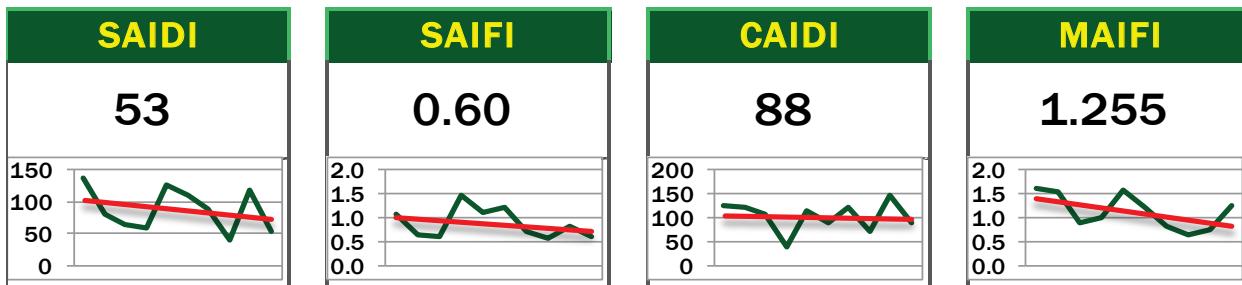


Regional Summary

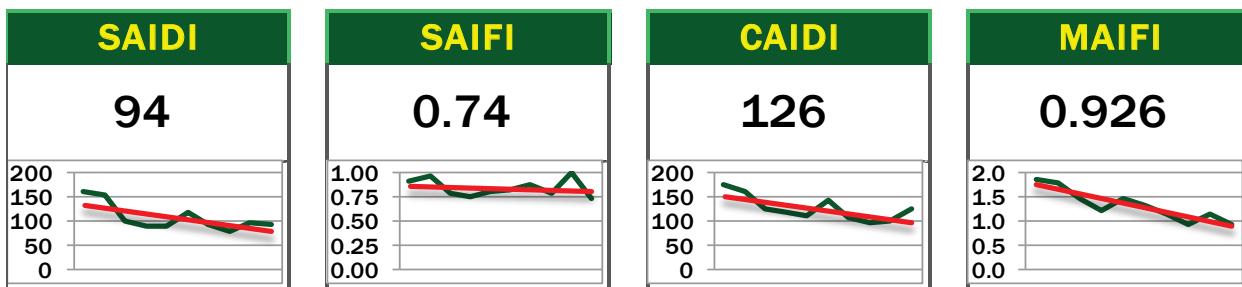
The Inland Empire Region consists of six SCE districts. These districts are 1) Arrowhead, 2) Menifee, 3) Ontario, 4) Palm Springs, 5) Redlands, and 6) Wildomar. All districts showed notable improvement with the Arrowhead District showing the largest improvement in the State. While Arrowhead still has a high 2015 SAIDI score of 363, all reliability metrics show marked improvement over that past ten years. In general, all metrics declined with the exception of Redlands District CAIDI. Menifee District had a recent spike in outage duration.



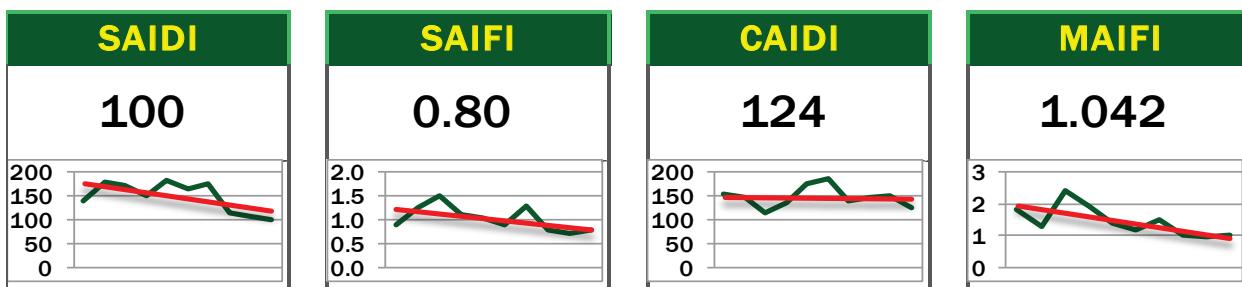
SCE Inland Empire - Wildomar District



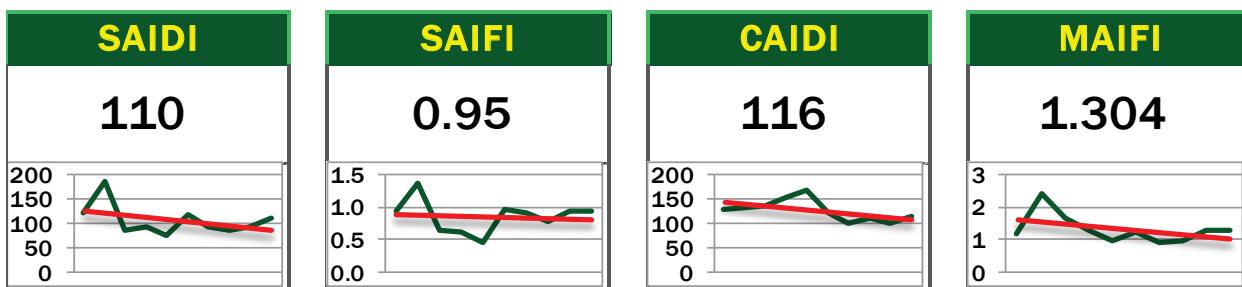
SCE Inland Empire - Ontario District



SCE Inland Empire - Palm Springs District

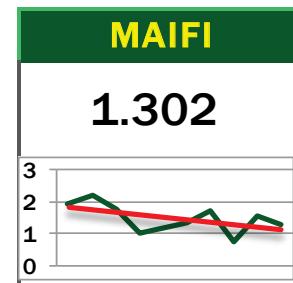
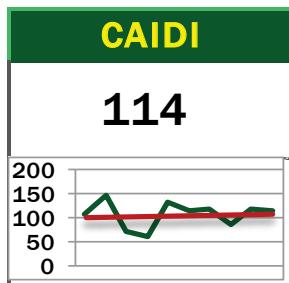
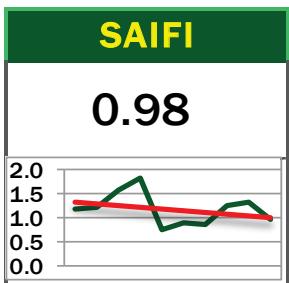
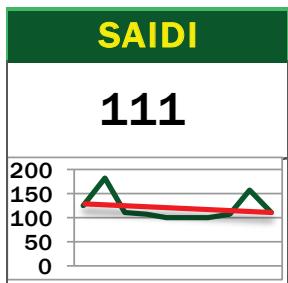


SCE Inland Empire - Foothill District

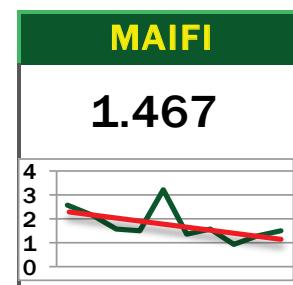
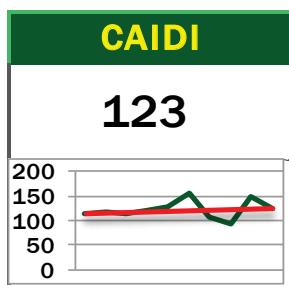
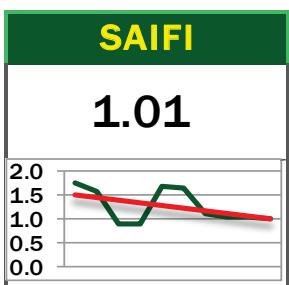
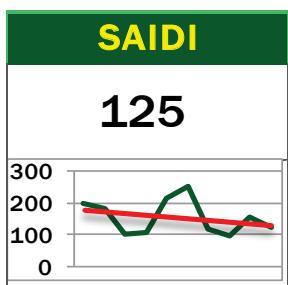




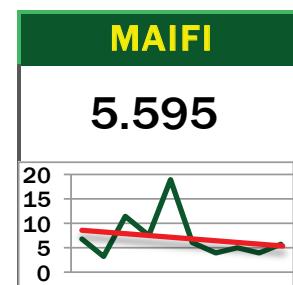
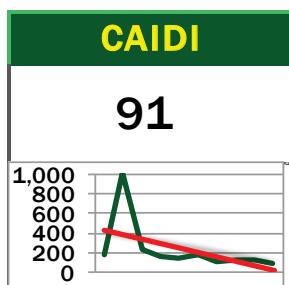
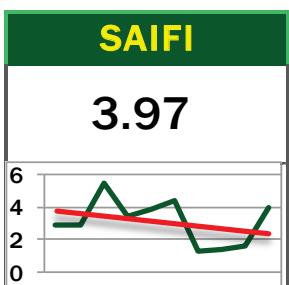
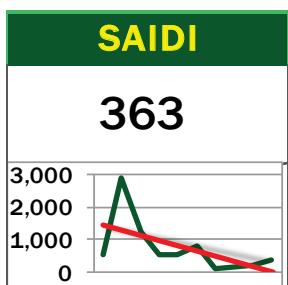
SCE Inland Empire - Menifee District



SCE Inland Empire - Redlands District



SCE Inland Empire - Arrowhead District





Desert Region

Figure 17
Desert Region

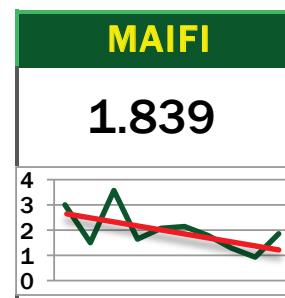
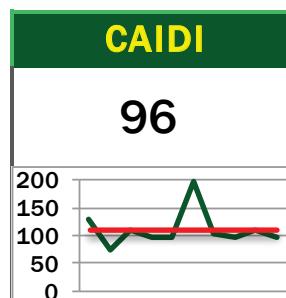
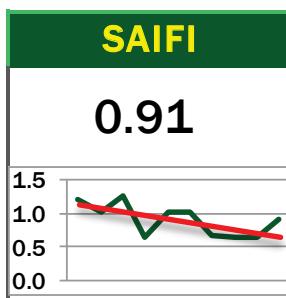
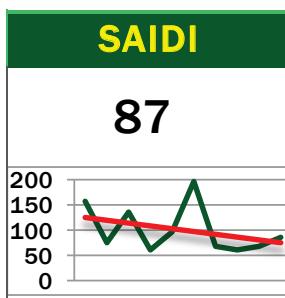


Regional Summary

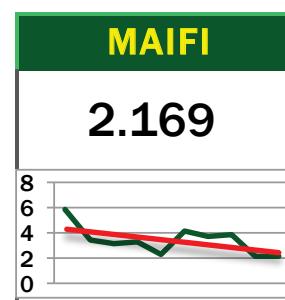
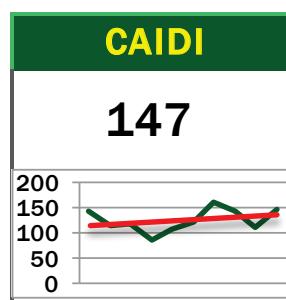
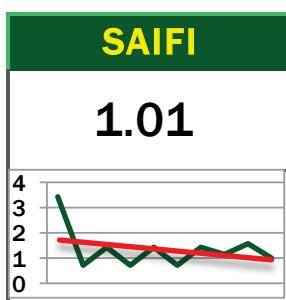
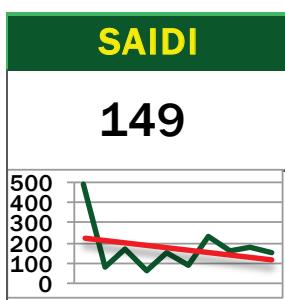
The Desert Region consists of seven SCE districts. These districts are 1) Barstow, 2) Bishop, 3) Blythe, 4) Ridgecrest, 5) Big Creek, 6) Victorville, and 7) Yucca Valley. Three districts showed reasonable improvement but two districts, Yucca Valley and Blythe, showed a decline in reliability performance. Barstow and Bishop showed stable metrics for the 10-year period.



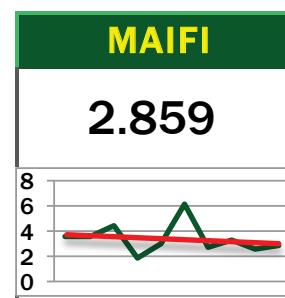
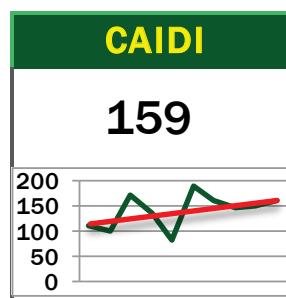
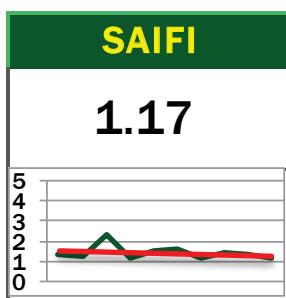
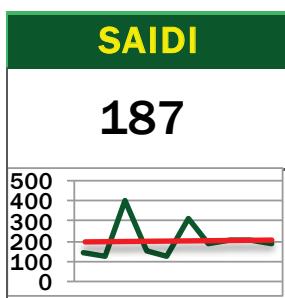
SCE Desert - Victorville District



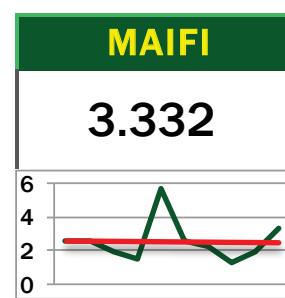
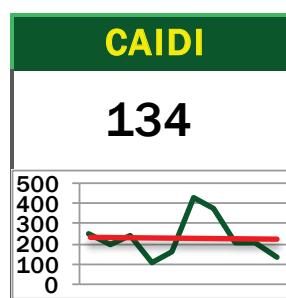
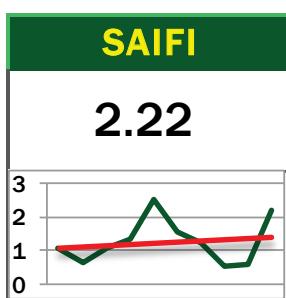
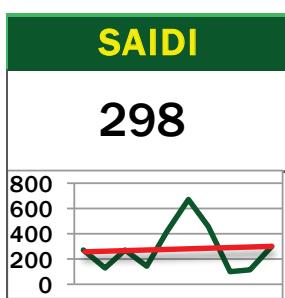
SCE Desert - Ridgecrest District



SCE Desert - Barstow District

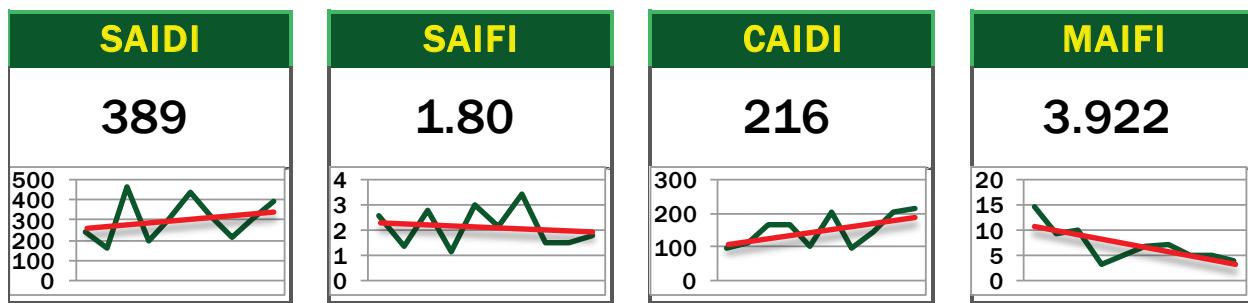


SCE Desert - Bishop District

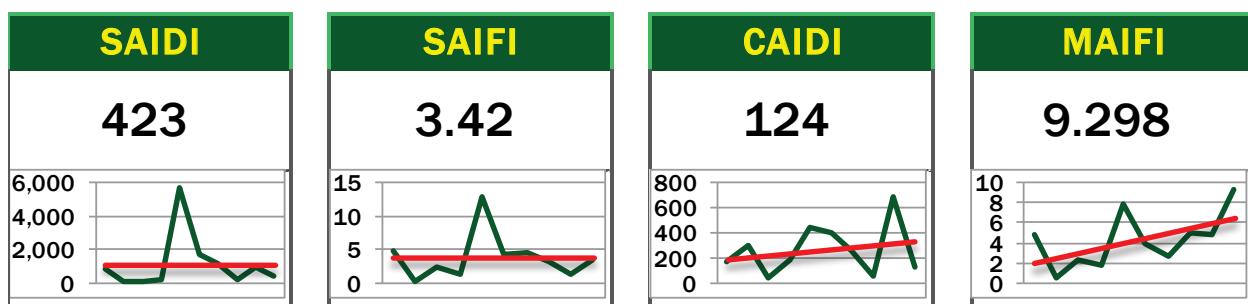




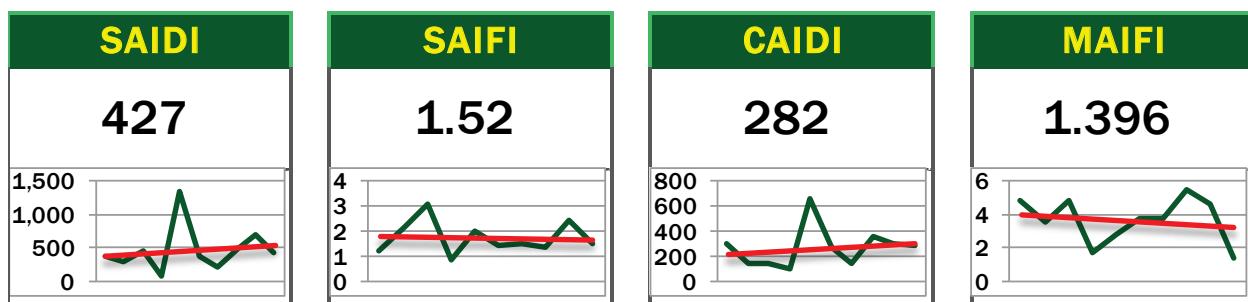
SCE Desert - Yucca Valley District



SCE Desert - Big Creek District



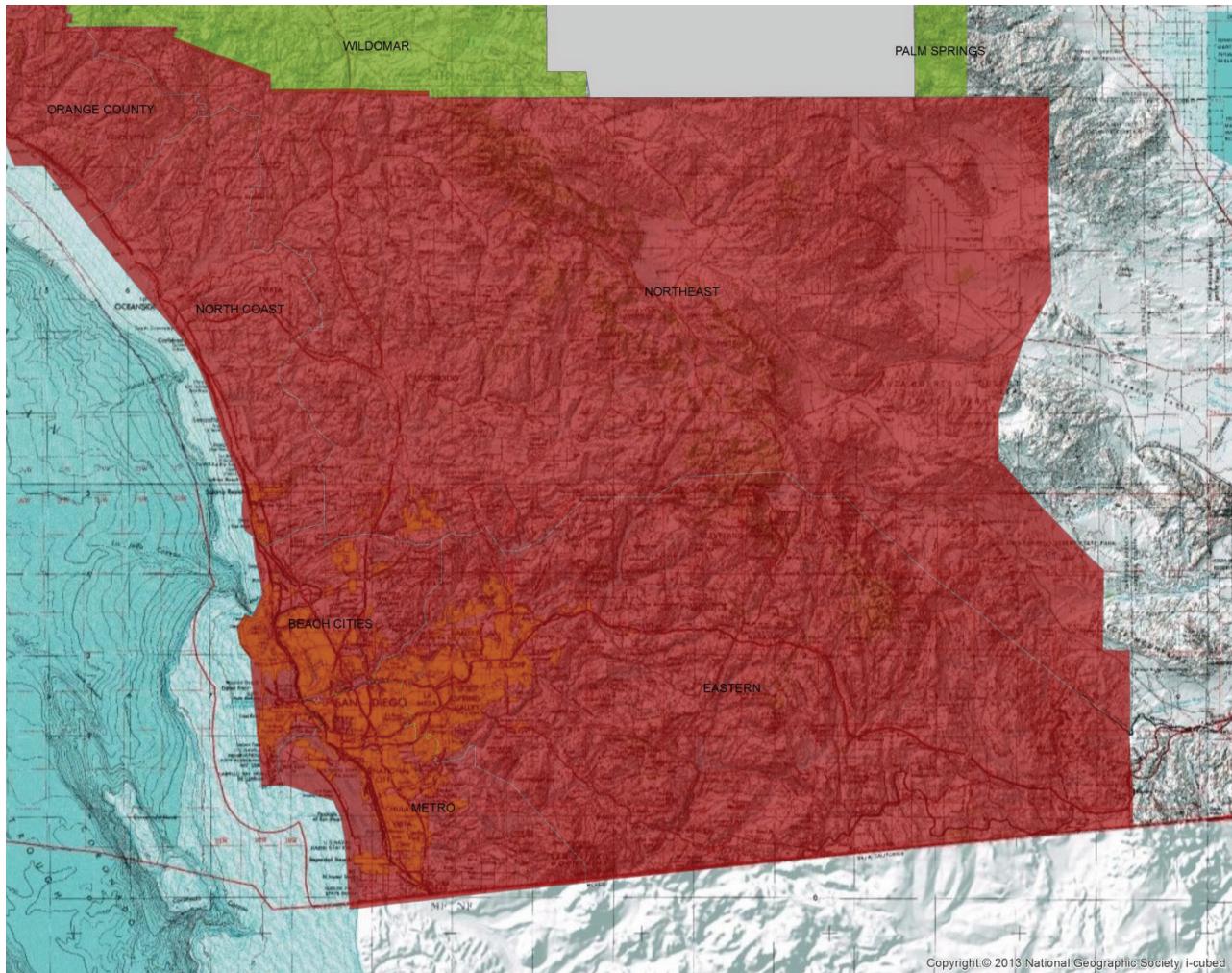
SCE Desert - Blythe District





San Diego Region

Figure 18
San Diego Region

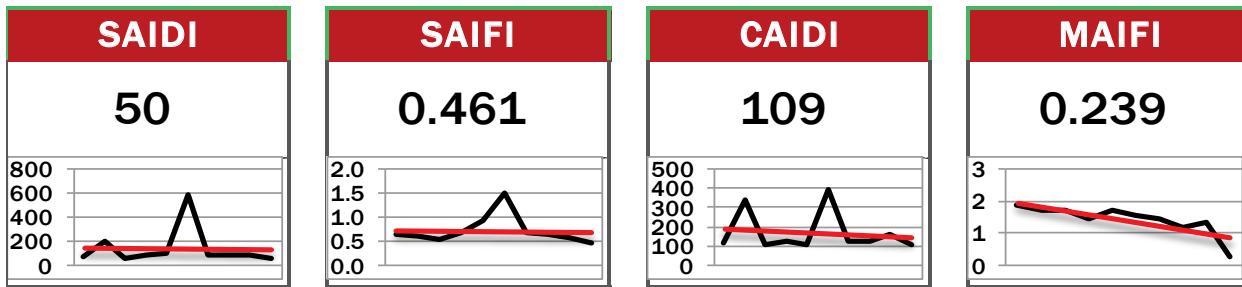


Regional Summary

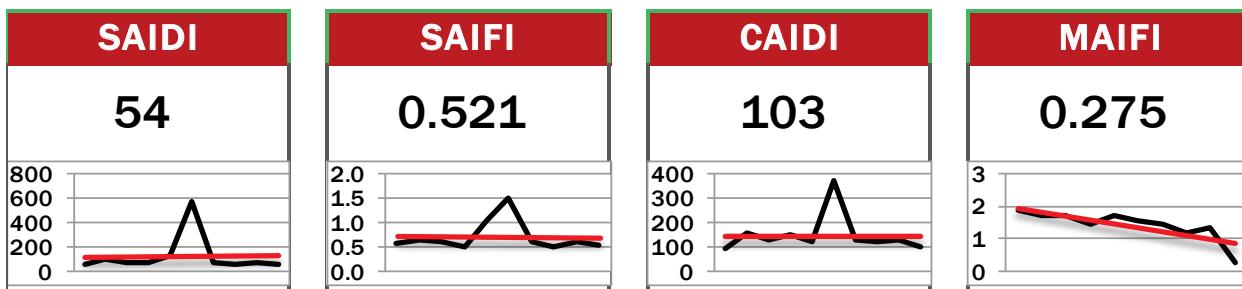
The San Diego Region consists of five SDG&E districts that consistently have the reliability performance in the State, with SAIDI scores ranging from 50-71. These districts are 1) Northeast, 2) Eastern, 3) North Coast, 4) Beach Cities, and 5) Construction Metro. While reliability metrics for these divisions indicate a decline in reliability performance, it is a result of the 2011 regional transmission outage. Otherwise reliability in this region continues to follow a consistent, high level of reliability performance. Momentary outages have shown steady decline in this region.



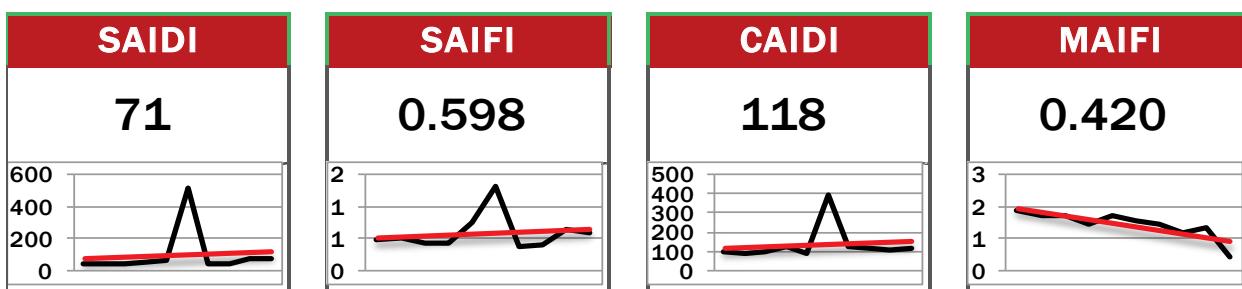
SDG&E San Diego - Eastern Division



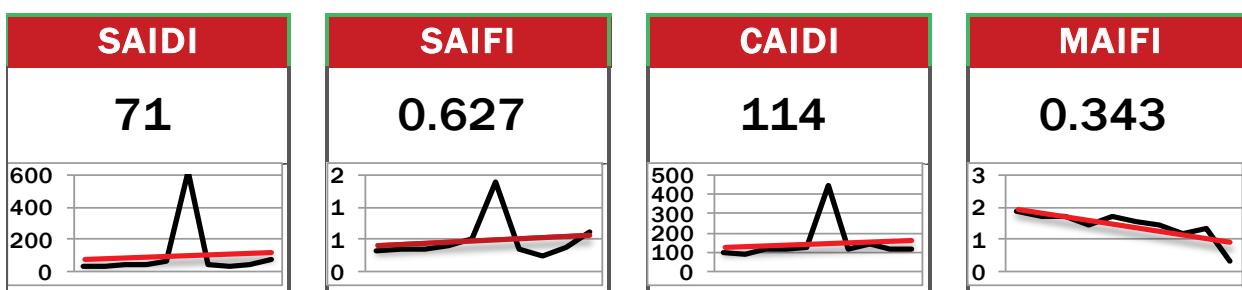
SDG&E San Diego Region - North Coast Division



SDG&E San Diego Region - Construction Metro Division

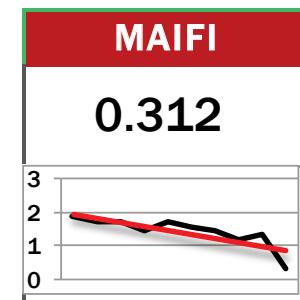
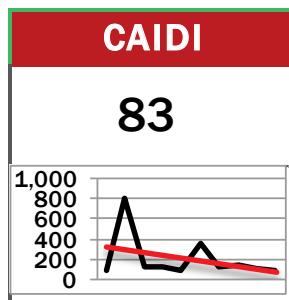
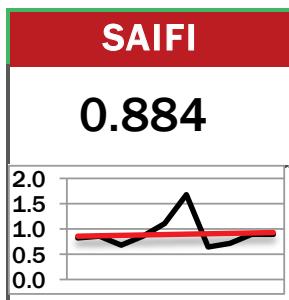
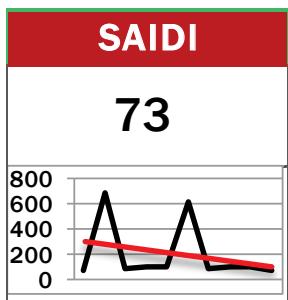


SDG&E San Diego Region - Beach Cities Division





SDG&E San Diego - Northeast Division





Conclusion

A review of California investor-owned utilities' reliability data for the years 2006-2015 show that overall electric reliability has improved and is at a satisfactory level for all three utilities considered in this study. Despite a major regional transmission outage in 2011, San Diego reliability metrics demonstrated consistently superior reliability performance, with the lowest scores in the State for three of the four reliability metrics.

Southern California Edison system wide is a close second, with improvement over the past 10 years. PG&E, which had previously had high reliability scores, has in the past 10 years has demonstrated significant improvement, with a steep decline in reliability scores to where it is close to SCE and SDG&E in terms of reliability performance. The exception is in the metric measuring restoration time, CAIDI, which shows SCE to be the lowest time to restore, followed by SDG&E and PG&E. For all three utilities, the time to restore service has declined over the 10-year time period.

Similarly, an examination of the 60 districts and divisions in the IOU service territories provided a granular view of reliable electric service in California, again showing marked improvement in reliable service, particularly in PG&E service territory and consistent superior reliable service in SDG&E service territory. Many of SCE districts showed improvement as well, but with some outlier districts, particularly in Los Angeles County, where reliability metrics indicate that reliable electric service has declined over the past ten years.



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